GIFTED FEMALES' AND MALES' CAUSAL ATTRIBUTIONS FOR MATH PERFORMANCE

By

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A DISSERTATION PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA

1989

Dedicated lovingly to my parents,
Jack and Eleanor Cramer

ACKNOWLEDGMENTS

The completion of a doctoral program is truly an onerous, exacting endeavor; without the assistance and support of several individuals this would not be possible. I wish to thank the members of my committee, Drs. Mary Kay Dykes, M. David Miller, Patricia Miller, John Gregory, and Paul Fitzgerald, for their suggestions, editing, encouragement, and support throughout the writing and rewriting of my dissertation. It is impossible to thank adequately my committee chairperson, Dr. Mary Kay Dykes, for all the guidance, suggestions, and weekend reading she has done to help me stay focused and on task during my doctoral studies. She is a deeply committed professional and a caring individual, and she has been a constant source of encouragement to me. I will attempt in the future to provide individuals with the quality of guidance that she has provided to me.

A special warm and loving thanks go to my my parents, who have not only been parents, but two of the best friends anyone would ever have. Words could never express my appreciation of and love for them. They have unselfishly provided me with their time, patience, encouragement and love. They are truly genuine, lovely people and I have much admiration for both of them. My brother David also seemed to always have an encouraging word, and his concern meant a lot to me.

I am grateful to Scott Lamb, Eddie Whittle, and John Rine, friends to whom I will always be close. They provided encouragement and humor, and

influenced me not to take things too seriously. They often kidded me about my idiosyncracies, and generally have worked to keep me humble over the years.

I am also grateful to Diane Gorum, Jim DeMark, Tim and Kim Dike, and Karen Shrontz for their belief in me and for their warm support. Good times and relaxation always seem to accompany my association with them, and they have helped me cope with the rigors of my doctoral program. John Poidevant, who toiled through this doctoral program at the same time I did, and who often experienced the same frustrations, also is to be thanked for his assistance and comaraderie. He kept me laughing and often helped me put things in perspective. Kurt Elmhorst was also a good friend who provided laughs and who helped me to relax and feel comfortable about life in general.

I am especially indebted to Takako Oshima, who has given me an inordinate amount of support, love, and encouragement during these past three years on both a professional and personal level. Her assistance and expertise were invaluable contributions to my dissertation. Her warm, caring, generous, and unconditional love for me will always be cherished.

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GIFTED FEMALES' AND MALES' CAUSAL ATTRIBUTIONS FOR MATH PERFORMANCE

By

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August, 1989

Chair: Mary K. Dykes
Major Department: Counselor Education

The underrepresentation of gifted females in math-related careers when compared to gifted males has raised questions about the social implications and nature of this discrepancy. Although numerous researchers have investigated various factors which might explain the achievement discrepancies in math-related careers between gifted males and gifted females, few investigators have delineated the causal attributions of gifted females for math outcomes. Numerous researchers have shown that the causal attributions one makes for an achievement outcome are linked with expectations of success on future tasks, with task preference, and with persistence on academic tasks.

The purpose of this study was to examine whether gifted female students demonstrated unique causal attributions for math performance which could be deemed as counterproductive and whether a pattern of causal attributions would differentiate gifted female students from gifted male students and from nongifted male and female students. The study examined developmental differences in causal attributions for math performance; gifted females were

compared to those of gifted males and nongifted peers in their causal attributions for math performance in grades 3, 6, and 9. The School Achievement Responsibility Scale (SARS) was administered to 303 children in a Central Florida school district to assess causal attributions for mathematics performance.

For gifted students, significant interactions of sex by grade were noted in their causal attributions for math performance on all four dependent variables (effort, ability, task, and luck) for both success and failure outcomes, indicating that the sex differences depended on the grade level. Moreover, the significant differences occurred only in the ninth grade. Gifted females evidenced self-defeating causal attributions for math performance relative to gifted males in the ninth grade for six of the eight dependent variables. For the nongifted subjects, significant sex differences were not as pronounced as those for the gifted subjects.

Based on the results of this study it was suggested that there was a need for developing attribution training programs in mathematics. A need for developing appropriate intervention strategies for gifted females to remediate self-defeating causal attributions for math performance was emphasized.

CHAPTER 1
INTRODUCTION

Despite recent attempts to increase the participation of women in advanced educational training and high-status professional occupations, females in general, and gifted females in particular, are still underrepresented in many occupational and educational settings when compared to their gifted male counterparts. The possibility that sex differences in educational and occupational choices may reflect differential use and development of human potential has aroused special concern among educators and social scientists (Eccles,1985; Farmer, 1985). The fact that the individual and society may be deprived of the skills of a portion of able citizens is disconcerting, especially in view of the fact that many women have sufficient intellectual talent to participate fully in these educational and occupational settings. Indeed, as Ohlsen and Matthews (1987) related, gifted females seem to be evident early in life but then {many} "disappear."

Of particular concern is the low percentage of females who enter careers in science, engineering, and related professions when compared to males (Meece, Eccles Parsons, Kaczala, Goff, & Futterman, 1982). One contributing factor is insufficient training in mathematics. Although males and females perform equally well in mathematics during their grade-school years, certain gender differences tend to appear during adolescence that have not been evident at earlier ages. Such differences include boys scoring consistently higher than girls on math and science aptitude tests, with these differences

being especially marked among gifted students (Benbow & Stanley, 1982b). As early as seventh grade males are more likely than females to perceive math as important to future career goals (Fennema & Sherman, 1977). In addition, researchers have consistently noted that gifted girls in high school are less likely than gifted boys to enroll in accelerated or special programs (Benbow & Stanley, 1982b), to enroll in math and science courses (Benbow & Stanley, 1982a), to perceive themselves as competent in math (Brush, 1980), and to express an interest in majoring in science or engineering in college (Benbow & Stanley, 1984). These differences appear despite the fact that during the elementary school years girls typically score as well as boys on standardized math achievement tests (Sherman, 1980).

The achievement patterns in mathematics for gifted females when compared to those of gifted males in mathematics are especially perplexing because competence and confidence in learning mathematics have been identified as critical mediators of both educational and occupational choices (Eccles, 1985). Mathematical skills are important for admission to many college majors, for many professional occupations, and, increasingly, for many computerized technical occupations as well (Fox, Benbow, & Perkins, 1983).

Although the literature is replete with examples of the differential achievement patterns for gifted females and gifted males as mentioned above, the explanation for these patterns is less consistent. Considerable attention has been directed toward understanding the biological (e.g., genetic, brain organizational, and hormonal) factors as well as the social and psychological (e.g., sex-role socialization, external discrimination, institutional barriers, fear of success in females, and achievement motivation) factors that have been hypothesized to influence performance differences (Benbow & Stanley, 1980; Eccles, 1985; Horner, 1972).

Numerous researchers have focused on social and psychological factors influencing the academic choices of gifted females (e.g., Eccles, 1985; Meece et al., 1982). Benbow and Stanley (1984), for example, found that differences in high school math enrollment for gifted males and females were significant even with the difference in the previously mentioned math aptitude test scores controlled. Eccles (1985) pointed out that even though differences on the aptitude measures favor males, gifted females "certainly have sufficient aptitude to make important contributions to science as well as other professions" (p. 262). Meece et al. (1982) further assert:

> Although women may receive less encouragement to continue their mathematical studies, it is not the case that they are being systematically excluded through discriminatory course availability. On the contrary, all too often women choose not to enroll in more advanced mathematics courses or to pursue math-related college majors. Therefore, the social and psychological factors influencing the academic choices of these students appear to play a crucial role in the problem. (p. 324-325)

The documented fact that gifted females have the intellectual ability to succeed at educational and occupational pursuits has led numerous researchers (e.g., Dweck, 1986; Eccles, 1985) to examine the potential importance of motivational influences on gifted females' achievement-related decisions. Understanding the factors that influence achievement motivation is important because motivation has been shown to affect achievement level (Farmer, 1985), level of occupation achieved (Sewell & Hansen, 1975), and career aspiration (Farmer, 1985).

Researchers have long recognized a relationship between achievement motivation and school achievement for the general population (Dweck & Elliot, 1983). During the past decade the emphasis in the study of achievement motivation has shifted to a social-cognitive approach--away from external contingencies on one hand, and global, internal states on the other (Dweck,

1986). It has shifted to an emphasis on cognitive mediators, i.e., how children interpret events in the situation, and the theme that a child's perception of reality, rather than reality per se, is the most powerful predictor of achievement motivation and behavior (Covington, 1984; Phillips, 1984). Numerous studies have been conducted showing that, although an adequate level of intellectual ability is essential to academic achievement, what children believe about their potential for school success and how they interpret school experiences also influence whether they seek or avoid challenges, whether they persist or withdraw in the face of difficulty, and whether they use and develop their skills effectively (Andrews & Debus, 1978; Butkowsky & Willows, 1980; Dweck, 1986; Licht & Dweck, 1984). Also consistent with the cognitive view of motivation is the finding that highly competent children do not invariably display effective patterns of achievement striving (Crandall, 1969; Licht & Dweck, 1984). The discovery of the relative independence of actual ability and motivational determinants is among the most intriguing findings to emerge from the cognitive view of motivation.

In a study conducted by Eccles, Adler, Futterman, Goff, Kaczala, Meece, and Midgley (1983) further evidence was provided of the importance of cognitive mediators in influencing achievement behavior. These researchers found that students' interpretations of reality (e.g., causal attributions for success and failure outcomes and self-concepts of ability) were more influential determinants of expectancies for success and course plans than were indicators of past reality (e.g., previous grades). In addition, Eccles et al. found that self-concept of ability was as powerful a predictor of subsequent course grades as was the students' past performance in math.

Within the realm of cognitive-motivational explanations of achievement, the causes a student gives for success and failure outcomes is a motivational

variable that appears to affect the child's academic achievement. Specifically, individuals' causal explanations, or attributions, for success and failure outcomes have received a considerable amount of attention during the past decade (Stipek & Weisz, 1981; Weiner, 1985).

Of the several approaches to studying perceived causation, the attributional model proposed by Weiner (1972) has become the basis for much of the subsequent research on achievement attributions. The original theory viewed the individual's affective, cognitive, and behavioral reactions to an achievement-oriented success or failure as a function of the person's causal explanations for the event. These causal explanations for achievement outcomes include ability, effort, luck, and task ease or difficulty. Although several researchers (e.g., Stipek & Weisz, 1981) have questioned the reliability of measurement used in attribution studies, Weiner's theory has been validated empirically by the work of Meyer (1980).

Attribution theorists argue that the perceived causes of success and failure have important implications, and these have been broadly applied to educational settings (e.g., Andrews & Debus, 1978; Schunk, 1984). Researchers have found that the differences in the causal attributions of children (e.g., attributing academic outcomes to such causes as ability rather than effort) are (a) correlated with academic affect and self-concept (Covington & Omelich, 1979), (b) associated with career aspiration (Farmer, 1985), (c) related to expectations for success in academic tasks (McMahan, 1973), and (d) altered by attributional training programs in ways that affect academic behaviors, such as persistence at tasks and task choices (Craske, 1985). These findings demonstrate the importance of studying individual differences in causal attributions and their applicability to educational settings.

Since the attributional model of achievement motivation was originally proposed, many researchers have used it as a means of explaining the differential achievement levels of men and women (e.g., Bar-Tal, 1978; Nicholls, 1980). The possibility that women might make different, self-defeating causal attributions (e.g., attributing failure outcomes to stable, uncontrollable causes such as a lack of ability) when compared to men was raised as an explanation for sex differences in traditional achievement patterns (e.g., female underachievement). This hypothesis and subsequent research concentrated on the normal distribution and not on gifted children per se..

In spite of substantial evidence that researchers have produced regarding causal attributions and achievement behaviors, it has not been possible to reach a consensus about sex differences in causal attributions for the general population (Sohn, 1982; Whitley, McHugh, & Frieze, 1986). The problem, as is commonly recognized, is the inconsistency or unreliability of findings across investigations. Study outcomes frequently fail to replicate earlier findings.

Inconsistency in the evidence has led some researchers to question the importance of sex differences in causal attributions in a generalized sense, and to ask a more qualified question: Under what conditions and/or in what academic content areas might girls and boys evidence different causal attributions (Eccles Parsons, 1983; Stipek, 1984). A number of researchers have found that people ascribe different causal attributions for various types of situations (e.g., Frieze & Snyder, 1980). Consequently, recent studies have specifically focused on gender differences in causal attributions across academic content areas, and in particular, mathematics (Ryckman & Peckham, 1987; Winn & Ryckman, 1986). A consistent sex difference has been demonstrated in causal attributions for the general population for mathematical tests and course grades. Girls rank effort as a more important cause of their

math success than do boys of equal attainment, and girls attribute failure on math exams to lack of ability significantly more often than do boys of equal attainment. In contrast, the boys rate ability as a more important cause of their success (Eccles, Adler, & Meece, 1984; Stipek, 1984). Eccles (1985) asserted that this pattern of sex differences has important consequences for females' decisions regarding future involvement with mathematics and math-related professions. She states: "People who view consistent effort as the most important determinant of their success in mathematics may avoid future courses if they think future courses will be more difficult, demanding even more effort for continued success" (p. 271). In an experiment conducted by Stipek (1984), fifth and sixth grade girls attributed their failure on a math exam to lack of ability significantly more often than boys, and boys attributed their success to ability significantly more often than girls. These causal attributions resulted in significantly lower expectations for success in math for the girls than for the boys.

It is noteworthy that mathematics is an area of achievement in which attribution researchers have found fairly consistent sex differences on a set of variables mediated by causal attributions. Compared to male students, females have lower achievement expectancies in mathematics, lower self concepts of their math ability, and slightly higher levels of math anxiety (Brush, 1980; Eccles Parsons, 1983).

In addition, sex differences in math expectancies and self-concept also seem to be developmentally sensitive. Differences between girls and boys in the normal range of ability are not significant at early ages, but do appear by late junior high school age (Heller & Parsons, 1981). With regard to causal attributions and developmental trends, Kessel (1979) found that tenth grade boys attributed their math success significantly more often to ability than did

tenth grade girls. This difference in causal attributions was not seen among sixth grade children, a finding conflicting with Stipek's (1984) finding of sex differences among fifth and sixth grade children.

Although causal attributions for gifted females and males have received little attention, several researchers have suggested that sex differences in achievement-related cognitions may be evident among the most academically competent children (Dweck, 1986; Licht & Dweck, 1983; Licht & Dweck, 1984). Stipek and Hoffman (1980), for example, found a surprising tendency for third grade girls' expectations of success on a novel intellectual task to be negatively related to their previous levels of academic achievement. Similarly, Licht and Shapiro (1982) found that sex differences in causal attributions (with girls being more likely than boys to attribute their difficulties to insufficient ability) emerged only among "A" students for performance on a novel task. Although these studies did not assess causal attributions for mathematics performance, taken together these studies suggest that a significant number of high-achieving girls may not be accurately processing their previous success experiences.

In summary, although investigators have suggested recently that causal attributions are situationally induced, current emphasis in the attribution literature is focused on causal attributions in relation to academic content areas. However, this question has not been investigated thoroughly with gifted females and males.

Statement of the Problem

The problem addressed in this study was whether gifted girls evidenced self-defeating causal attributions for math performance when compared to gifted males and other groups of students. Eccles (1985) has stated that to date no research has been conducted specifically investigating causal attributions for mathematics performance for gifted students, and that causal attributions have

rarely been assessed for math performance in naturalistic settings. Although the causal attributions of gifted students' math performance were examined in this study, special focus was placed on examining the causal attributions of gifted females. This emphasis was maintained throughout this study due to the achievement-related discrepancies in math performance described earlier favoring gifted males. In addition, both Callahan (1979) and Eccles (1985) have noted that the present understanding of gifted girls' abilities and achievement motivation is inadequate. Although numerous researchers have investigated various factors which might explain the achievement discrepancies in math-related careers between gifted males and females, few investigators have delineated the unique characteristics of gifted females which might guide educators in their understanding of achievement motivation in gifted girls.

Of particular importance to the issue of achievement motivation are studies which investigate obstacles to gifted females' achievement, such as self-defeating causal attributions for math performance (Eccles, 1985). The possible identification of debilitating causal attributions for gifted girls for math performance would yield significant findings and have implications for understanding cognitive foundations for gifted girls' achievement behaviors in math. Numerous researchers have shown that self-defeating causal attributions are linked with lowered expectations of success, with achievement-debilitating affect, with making unchallenging task choices, and with reduced persistence on achievement tasks (Andrews & Debus, 1978; Dweck, 1975; Licht & Dweck, 1984; Licht, Linden, Brown, & Sexton, 1984). In addition, individuals exhibiting self-defeating causal attributions may possess high-level academic skills, but perform in a classroom below their abilities (Licht & Dweck, 1984; Stipek & Hoffman, 1980).

Identified debilitating causal attributions for math performance may have important negative consequences for gifted girls' decisions regarding future involvement with mathematics and interest in math-related professions. Presently, causal attributions for math performance have not been researched for gifted females. In addition, from a developmental perspective, all children make increasingly consequential academic and career decisions in adolescence, and self-defeating causal attributions may impair gifted girls' achievement behaviors and constrict their future choices, especially in mathematics. At the current time there is a lack of empirical data assessing developmental changes in causal attributions for gifted girls with regards to mathematics. The need to assess gifted girls' causal attributions for mathematics performance from a developmental perspective thus also appears warranted.

Furthermore, no studies have examined the causal attributions of gifted males for math performance. As Eccles (1985) pointed out, such research appears warranted in developing an understanding of gifted males' cognitive-motivational factors in math and in postulating a plausible explanation for the achievement discrepancy in math between gifted males and gifted females.

Need for the Study

If it were known that gifted females were exhibiting self-defeating causal attributions for mathematics performance when compared with gifted males and other groups of children, this knowledge would yield significant implications for the study of achievement motivation in mathematics among gifted females. Specifically, these implications would be in the areas of theory, practice, training, and research. From a theoretical perspective, the presence of an identifiable pattern of causal attributions in gifted females could assist in theoretical formulations for a cognitive-motivational explanation of the

underrepresentation of gifted females in advanced math courses and math-related careers. Although sex differences in math are generally small in magnitude when they are reported for the entire population considered together, sex differences among gifted males and females in math tend to be large (Benbow & Stanley, 1982a). As a result, several researchers have suggested the need to investigate the causal attribution patterns of gifted students for math performance (Dweck, 1986; Eccles, 1985).

These theoretical implications lead directly to further ramifications for practice. Since students exhibiting debilitating causal attributions have been shown to have lowered expectations for success on future tasks (e.g., Stipek & Hoffman, 1980), even when they possess high ability (e.g., Licht et al., 1984), school psychologists, counselors, and educational personnel could use the results of this study to implement intervention strategies with a particular group of students who are likely to exhibit these causal attributions. In support of intervention strategies, researchers (e.g., Forsterling, 1985; Frieze & Snyder, 1980) have emphasized that children can be taught to employ a productive, beneficial, and realistic causal schemata for any situation, including academic subjects in school. For example, training childrens' causal attributions for failure (i.e., teaching them to attribute failure to effort instead of ability via didactic teaching and/or cognitive restructuring techniques) has been shown to produce sizable changes in persistence on difficult tasks and in higher expectancies for success on novel tasks (Andrews & Debus, 1978; Dweck, 1975; Forsterling, 1985). Attribution training could be implemented within a school setting for a group of students who might be vulnerable (i.e., gifted girls) in their causal attributions. In addition, from a developmental perspective, although programs designed to train children to change their causal attributions for failure have been successful (e.g., Dweck, 1975; Schunk, 1984), it clearly

would be more efficient and effective to identify vulnerable groups of children who could benefit from early intervention strategies in preventing the development of self-defeating causal attributions in the first place.

The results of the current study could have implications for training. By training educators to recognize the impact of the causal attributions that children use to structure their environment and by developing techniques to foster beneficial belief systems, the education system can mold what attribution theorists believe to be the key components of academic motivation and behavior. It can be emphasized for educators that the examination of causal attributions be a vital element in the school curriculum. In a similar vein, Bar-Tal (1978) has suggested the possibility of introducing formal training programs for students that resemble the personal causation training done by DeCharms (1972). DeCharms' program, which was designed to train teachers to change childrens' self-perceptions, resulted in academic improvement of participating students.

The results of this study also have significant implications for further research questions. To date, attributional interventions have been conducted with less successful students. Yet, the earlier discussion suggests that some of the brightest students, who in grade school as yet show little or no obvious impairment in mathematical performance, may be prime candidates for such motivational intervention, particularly as they enter junior high and high school when mathematics courses become increasingly complex (Dweck, 1986). The importance of identifying a group of students who are particularly vulnerable in their causal attributions for math performance can provide further impetus for refining attribution training techniques with these groups of students.

Purpose of the Study

The primary purpose of this study was to examine whether gifted female students demonstrated debilitating causal attributions for math performance and whether this performance could differentiate gifted female students from gifted male students and nongifted male and female pupils. In addition, this study included an examination of developmental differences thought to be relevant to these causal attributions. Gifted females were compared to gifted males and to nongifted children in their causal attributions for math performance in grades 3, 6, and 9.

Research Questions

The research questions addressed in this study were:

1. Are there significant differences in causal attributions for mathematics performance between gifted females, gifted males, nongifted females, and nongifted males as a function of grade (a three-way interaction between grade, educational classification, and sex)?
2. Are there significant differences in causal attributions for mathematics performance between gifted females and gifted males, and between nongifted females and nongifted males as a function of grade (a two-way interaction between grade and sex)?

Definition of Terms

Achievement motivation consists of psychological factors other than intelligence that affect whether an achievement goal is pursued, which achievement goal is pursued, how vigorously it is pursued, and how long it is pursued. These factors, along with the child's ability, combine to determine the quality of that child's learning and performance.

Attribution theory of achievement motivation is the assumption that individuals' beliefs and perceptions about the outcomes they experience guide their subsequent behavior in achievement situations. The focus is on specific causal explanations (e.g., ability, effort, task ease or task difficulty, and luck) individuals give about success and/or failure outcomes that are believed to mediate expectations of future success and persistence on achievement tasks.

Causal attributions are explanations given by individuals for success or failure outcomes. Although numerous explanations can be given by students for success and failures, among the most prevalent are ability, luck, task ease or difficulty, and effort (Weiner, 1979).

Self-defeating/debilitating causal attributions are causal attributions characterized by the ascription of failure outcomes to ability and task (stable factors) and ascriptions of success outcomes to effort and luck (unstable factors). Many researchers (e.g., Dweck, 1975; Licht & Dweck, 1984; Weiner, 1985) have indicated that when an individual attributes a failure outcome to lack of ability, for example, lowered expectancies for success and reduced persistence on subsequent tasks result.

Self-enhancing causal attributions are causal attributions characterized by the ascription of failure outcomes to effort and luck, and ascriptions of success outcomes to ability and task (Weiner, 1979).

Gifted students were those students in the current study selected by the State of Florida Department of Education (1988) criteria which stresses superior intellectual development and the capability of advanced performance. The tested mental capacity of these students was two standard deviations or more above the mean, that is, an IQ standard score of 130 or more on an individually administered intelligence test. Additionally, for the purposes of this study, gifted

students were those individuals who obtained stanine scores of 8 or 9 for the mathematics section on a standardized, group-administered achievement test.

Nongifted students were those students selected, for the purposes of the current study, who possessed stanine scores of 5 or 6 for the mathematics section on a standardized, group-administered achievement test and who were not enrolled in gifted programs (or in the referral process for a gifted program).

Overview of Remainder of Study

A review of literature is presented in Chapter 2. Variables under investigation are discussed in Chapter 3. Methodological issues such as research design and statistical procedures are also described. Results of the data analysis and statistical summary tables are presented in Chapter 4. The results and summary of the study are presented in Chapter 5. Limitations and implications for future research are also discussed.

CHAPTER 2
REVIEW OF THE LITERATURE

The problem addressed in this study, causal attributions for mathematics performance among gifted females and males for grades 3, 6, and 9, has not previously been researched, although researchers have investigated, to varying degrees, children's causal attributions as a function of sex, achievement level, age, and/or academic content. The available literature most closely related to this problem was chosen for review and discussion: A general overview of attribution theory and its implications for achievement motivation, achievement-related characteristics and causal attributions among gifted and nongifted children, developmental issues in children's causal attributions, and gender differences in making causal attributions. The chapter is concluded with a brief summary of the contents of this review.

Attribution Theory Overview: A Cognitive Approach to Motivation

Basic Considerations

Attribution theory is conceptualized within the realm of cognitive psychology, which is primarily concerned with how incoming information, as a source of information, is translated into belief systems that give meaning to the external environment (Heckhausen, Schmalt, & Schneider, 1985). These intervening thought processes of perceptions and beliefs are the focus of study in a cognitive approach to motivation.

The principle cognitive elements examined in attribution theory are causal attributions, or explanations, made by individuals for their own action outcomes and those of other persons (Heckhausen et al., 1985). Causal attributions serve

as explanatory elements because individuals are generally not content simply to register events in their environment, but rather they attempt to trace back these events to particular causes (Weiner, 1972). Causal attributions have the function of providing meaning to environmental events, thus allowing individuals to predict and control their behavior (Heckhausen et al., 1985). Wong and Weiner (1981) found that individuals do engage in attributional searches when confronted with achievement outcomes, particularly in reaction to failure outcomes.

Weiner's Attribution Model

As proposed by Weiner (1972; 1979; 1985) in achievement-related contexts, a number of causes, including ability, effort, task difficulty, and luck are used to interpret the outcome of an achievement-related event. Although Weiner stated that there are additional perceived causes of success and failure (e.g., fatigue, mood, and illness), within the confines of academic accomplishment he postulated that ability and effort typically are believed to be the dominant causes of success and failure, and that task difficulty and luck were perceived to be among the remaining causes of achievement (Weiner, 1979).

Cooper and Burger (1980) investigated whether the four causal factors derived by Weiner actually were sufficient for an adequate description of the attributional process for success and failure. In their study subjects were asked to make causal attributions for their own (fictitious) achievements. Cooper and Burger showed that ability, effort, luck, and task difficulty were among the main perceived causes of achievement performance. Within this list of causes, ability and effort appeared to be the most salient and general of these causes.

Weiner's (1979) theory is not explicit as to the origin of the types of causal attributions found among pupils but he classifies the type of attribution made

using a three-dimensional taxonomy of the causes of success and failure (see Table 1).

Table 1

Weiner's Taxonomy

	Internal		External	
Controllability	Stable	Unstable	Stable	Unstable
Uncontrollable	Ability		Task difficulty	Luck
Controllable		Immediate effort		

One dimension is the internal-external description of causes often associated with the field of locus of control (Rotter, 1966). Ability and effort are properties internal to the person, whereas task difficulty and luck are external causes. Weiner (1979) referred to this dimension as the "locus of causality". A second dimension of causality, labeled "stability", characterized causes on a stable (invariant) versus unstable (variant) continuum. Ability and task difficulty were likely to be perceived as relatively fixed, whereas luck and effort are more unstable: luck implies random variability and effort may be augmented or decreased from one episode to the next (Andrews & Debus, 1978). A third dimension of causality, first proposed by Heider (1958) and then relabled by Weiner (1979), was "controllability". According to Weiner, some causes, such as effort, have been perceived as controllable, whereas ability has been perceived as uncontrollable. Ability has been viewed as the more fixed aspects of aptitude and intelligence and not the more variable and learnable aspects, such as skill.

An investigation by Meyer (1980) provided the strongest support for Weiner's taxonomy. Meyer (1980) presented his subjects with questionnaires describing 16 different situations and asked them to indicate for each situation to what extent each of nine causal elements was responsible for the outcome. The questionnaires were subjected to a three-mode factor analysis. The three factors represented in the nine causal elements and the 16 situations corresponded to the dimensions of stability, locus, and controllability.

Research with Attributions and Achievement Behavior

A major tenet of the attributional model of achievement motivation is that causal ascriptions influence and perhaps even determine subsequent achievement behaviors (Weiner, 1979). Many investigators have shown that causal attributions of success and failure mediate a variety of achievement-related cognitions and behaviors, including cognitive expectancies of success (McMahan, 1973; Stipek & Hoffman, 1980), persistence in the face of difficulty (Butkowsky & Willows, 1980), affect (Covington, 1984), and task selection (Fyans & Maehr, 1979; Licht & Dweck, 1984).

Meyer (1980) investigated the relationship between causal attributions and cognitive expectancies of success. In two similarly designed experiments he induced success or failure on five consecutive tasks. Subjects who attributed their failures primarily to task difficulty and lack of ability indicated without exception relatively lower probabilities of success. Those who attributed their failures primarily to the variable elements (effort and luck) reported without exception relatively higher probabilities of success.

Task persistence has been the most closely examined achievement behavior within the attributional framework (Stipek & Weisz, 1981). The relationship between task persistence and causal attributions was demonstrated in a study by Dweck and Reppucci (1973). A group of fifth grade children were given

solvable block designs by a "success" experimenter and insolvable block designs by a "failure" experimenter. When the failure experimenter began to give solvable problems, some of the children failed to complete them, even though they were almost identical to the tasks they had mastered when given by the success experimenter. The children who showed performance debilitation in persistence attributed success and failure to the presence or absence of ability rather than to expenditure of effort. Children who persisted at the task administered by the failure experimenter tended to place more emphasis on the role of effort in determining the outcome of their behaviors.

Dweck (1975) provided evidence that the nature of persistence following failure can be changed by altering children's causal attributions for failure. In her study, children who previously had made causal attributions to lack of ability for failure were trained to attribute failure to lack of effort. The children who were trained to attribute failure to lack of effort showed greater persistence following failure than they had before the training program. Further evidence that children can be trained to make effort attributions for failure and that such training will result in greater persistence in the face of failure is provided by Andrews and Debus (1978), Fowler and Peterson (1981), and Reid and Borkowski (1987).

Stipek and Hoffman (1980) pointed out that altering children's attributions for failure has been conducted in view of the fact that often students' low expectations and lack of persistence are unwarranted, and that individuals exert little effort or give up easily at a task that they are, in fact, able to do. Children who frequently experience failure (e.g., mentally retarded children) have been found, for example, to have relatively low expectations for success, even at tasks at which they are no less able to succeed than high achieving children (Weiner, 1985)

Fyans and Maehr (1979) examined the relationship between causal attributions for achievement and their effects on task selection. They found that among students (fifth through twelfth grade) who believe that success is largely a function of luck (an external, unstable, uncontrollable factor in Weiner's paradigm), these individuals are likely to avoid ability tasks, i.e., tasks that reflect one's ability level. Similarly, Licht and Dweck (1984) summarized literature to indicate that individuals who attribute failure to insufficient ability tend to select familiar, unchallenging tasks and avoid novel, unchallenging tasks

Covington (1984) analyzed the correlations between causal attributions and achievement-related affect. He found that shame was experienced when a series of unexpected failures was attributed to low ability, and that anger was experienced when a series of unexpected failures was attributed to task difficulty.

Several researchers have indicated limitations in the attributional literature. Frieze and Snyder (1980) and Ryckman and Peckham (1987), for example, have found that causal attributions are domain (i.e. academic subject area) specific, yet, as Eccles (1985) pointed out, researchers often neglected to assess causal attributions in relation to school subject areas. Eccles (1985) also has noted that much of the research in the attributional literature is derived from highly contrived experiments. Attribution researchers have rarely ventured out of experimental settings and into real classrooms. Children typically have been asked to make causal attributions about hypothetical people doing hypothetical tasks. Stipek and Weisz (1981) pointed out that there is some evidence that children's responses on attribution measures might not be very reliable, and that there have been few attempts to examine reliability and validity issues in the measurement of causal attributions.

Attributions and Minority Populations

Although earlier researchers suggested that blacks tended to exhibit different causal attributions than whites (Friend & Neale, 1972), recent studies have challenged this view by documenting no differences between blacks and whites in their causal attributions (Graham, 1984). In two experiments conducted to examine the process of attributional thinking in black and white children who differed in social class, Graham and Long (1986) found no evidence that black children in general or disadvantaged black children in particular display different causal attributions than do white children. In summarizing recent research with ethnic minorities and social class, Graham and Long (1986) concluded that there is no reason to anticipate that children who differ in social class or race should be differentiated according to their dominant causal attributions for success or failure and in their perceptions of the underlying meaning of causal ascriptions. McMillan (1980) also found no differences in causal attributions among Caucasian, Negro, and Hispanic children.

Achievement-Related Characteristics of Gifted and Nongifted Children

Definition/Identification Issues of Gifted Children

Throughout history, the definition and identification of gifted and talented children have become considerably more complex. Definitions have been elaborated and altered, carrying with them concomitant changes in identification practices (Passow, 1985).

According to Freeman (1985) the most widely used definition of giftedness over the past decade is that established by the US Office of Education in 1972. This definition stresses the identification of children who demonstrate ability in several areas: general intellectual ability, specific academic aptitude, creative or productive thinking, leadership ability, visual and performing arts, and psychomotor ability. However, according to Kerr (1985), no universally agreed-

upon definition of giftedness has been formulated. Renzulli (1986), for example, asserted that the above definition fails to involve motivational factors such as task commitment and task diligence.

Traditionally, definitions of giftedness have stressed academic superiority. Therefore, it is not surprising that scores on intelligence tests, the most reliable predictors of academic success, have been emphasized with gifted children often described as those who are in the upper 3 to 5% on these tests (Whitmore, 1985). Freeman (1985) pointed out that the most frequently used identification instruments and procedures for gifted programs at the elementary school level were intelligence tests, achievement tests, teacher ratings, parent ratings, and academic performance.

Characteristics of Gifted Versus Nongifted Learners

Several studies have described characteristics that differentiate gifted children from other learners. Terman and his associates (Terman, 1925; Terman & Oden, 1959), who studied 1000 children with IQ scores of 130 or higher, observed some specific characteristics in these individuals: fast learning ability, scientific inclinations, enjoyment of learning, good abstract reasoning, high energy level, good imagination, and good command of language, among other characteristics. Subsequent reports have confirmed most of Terman's findings (Gallagher, 1975).

Significant differences have been found between gifted and nongifted learners in the cognitive strategies they select and use in problem-solving tasks, and in their cognitive development. To a significantly greater degree, gifted students have recognized the problem to be solved, readily generated a series of solution steps, and monitored solutions systematically (Sternberg & Powell, 1983). Within a Piagetian framework, Webb (1974) found that gifted learners between the ages of 6 and 11 had passed tasks at the advanced levels of the

concrete operations stage well in advance of their chronological peers. Keating (1975) correlated these findings in his studies of gifted 11-year-olds. He found that 75 percent of his gifted group were able to pass the formal operations tasks presented, thus leading credence to cognitive developmental precocity implications in gifted children.

Other characteristics that have been found to distinguish gifted and nongifted learners include gifted children being more persistent, motivated, and responsible for their learning than nongifted children. Gifted children have been described as more likely to have an internal locus of control than nongifted children (Li, 1988).

Gender issues have been examined by researchers in describing the nature of giftedness in children. In this vein, the identification and characteristics of gifted girls has received considerable attention in the past decade (Eccles, 1985). Although there appear to be equivalent numbers of identified gifted boys and girls in the elementary and junior high school years via teacher nomination and IQ score eligibility, by high school there are clearly more gifted boys identified that gifted girls. (Silverman & Read, 1985). Richert, Alvino, and McDonnell (1982) have postulated that girls are disadvantaged in the identification procedures for giftedness in many school districts, mainly due to sex role socialization and sex discrimination factors (e.g., passive, bright girls might not be noticed; the belief that girls should not be as concerned with intellectual pursuits as boys).

Researchers investigating achievement-related characteristics of gifted girls and boys have presented a mixed picture. For example, Terman and Oden (1959) found that gifted girls were more likely to underestimate their intellectual skills and knowledge, whereas gifted boys were more likely to overestimate theirs. Similarly, Fox (1982) found highly motivated gifted girls to be less

confident of their intellectual abilities than equally highly motivated gifted boys. In contrast, Tidwell (1980) found no sex differences on measures of general self-concept. Tidwell (1980) and Tomlinson-Keasey and Smith-Winberry (1983) found no sex differences on measures of locus of control (a construct often linked to self-confidence).

Causal Attributions of Nongifted and Gifted Children

On a variety of experimental and academic tasks, children of low and high achievement have been found to attribute their success and failure to different factors. Generally, investigators have indicated that low-achieving students (retarded, learning disabled, poor readers) attribute failure to lack of ability, while high-achieving students attribute failure more often to lack of effort (Butkowsky & Willows, 1980; Licht, Kistner, Ozkaragoz, Shapiro, & Clausen, 1985).

Although much has been written about the characteristics of gifted students (Freeman, 1985), there has been little research on how they manifest achievement-related cognitions, i.e., causal attributions for achievement outcomes

Post-Kammer (1986) examined differences in causal attributions for the academic success and failures of high school students participating in and not participating in programs for gifted students. Students were administered the Intellectual Achievement Responsibility Scale (IARS) to assess causal attributions. Post-Kammer found that students participating in gifted programs tended to attribute their success to their own ability to a greater degree than students not participating in gifted programs.

In an experiment conducted by Buckhalt (1985), students referred by teachers for a gifted program and students referred for evaluation because of learning difficulties were asked a series of questions about their causal

attributions for their best and worst performances on a standardized intelligence test. Buckhalt found that students referred to gifted programs tended more often to credit ability for success than to blame lack of ability for failure, with students referred for learning problems showing the reverse pattern in that they blamed lack of ability for failure.

Developmental Issues

Although the major work to develop the attributional model for success and failure events was initially done with college students, increasing attention has been given to children's causal attributions for success and failure (Whitley & Frieze, 1985). In general, it has appeared that quite young children are able to form meaningful causal attributions and that these attributions function in much the same way as they do in adults (Ruble, 1980; Stipek & Hoffman, 1980). Several researchers (e.g., Shaklee, 1976; Stipek, 1984) have suggested that beyond the primary years, children make much the same types of causal attributions as do adults. With regard to developmental factors in making causal attributions among the general population, attribution researchers have focused on (1) developmental trends in making causal attributions and (2) the developmental of realistic self-appraisal skills in making causal attributions (Winn & Ryckman, 1986).

Developmental Trends in Perceptions of Causes of Achievement Outcomes

Frieze and Snyder (1980) showed that children in first, third, and fifth grades make different causal attributions but with greatest emphasis on ability, effort and degree of task difficulty. Bar-Tal and Darom (1979) found eight causes to predominate among the causal attributions of 10-year-old children, among them being ability, effort, and task difficulty. Comparisons of these results with those obtained by Frieze (1976) among college students suggest a developmental trend in type and frequency of causal attributions made. They found a decrease

in controllable, unstable causes (e.g., effort) during the years from 8 to 17 and a corresponding increase of stable, uncontrollable causes (e.g., ability). Frieze and Snyder (1980) noted that the increasing use of stable and uncontrollable causes in older children to explain success and failure is supported in the work of Piaget (1930), who asserted that one of the last concepts to develop in children is the concept of chance. The incorporation of the concept of chance into the causal framework is represented by the use of more unstable causal attributions (e.g., luck, effort) by younger children.

This shift in perception of causes probably occurs because younger children do not differentiate between effort and ability (Stipek, 1984). It has been postulated by Dweck and Elliot (1983) that the most cognitively mature view of ability involves perceiving it as inversely related to effort, as it is then that children see ability as limiting the extent to which added effort can increase performance. In this regard, Cauley and Murray (1982) found that second-grade students, when asked to make causal attributions about causes of success and failure, treated the relationships between effort and ability in the manner adults do. Karabenick and Heller (1976) showed that by first grade, children demonstrated some appreciation of the inverse relation between effort and ability. Rholes, Blackwell, Jordan, and Walters (1980) further showed that children after age 7 begin to be able to conceive of ability as a more global, stable, psychological trait. These results are similar to Piaget's (1930) contention that children functioning in the preoperational (usually before age 7) stage lack a concept of stable ability. Children functioning in the preoperational stage are unable to consider two types of information in logical judgments of several varieties. It can be posited that ability and effort are examples of two such types of information. Concrete operational children (approximately ages 7

through 11), on the other hand, demonstrate successful information integration on the same tasks (Inhelder & Piaget, 1964).

Development of Realistic Self-Appraisal Skills in Causal Attributions

Many researchers who have studied childrens' behaviors have commented on children's uniformly positive, sometimes exaggerated, perceptions of their abilities (Inhelder & Piaget, 1964; Piaget, 1930; Stipek & Hoffman, 1980). Studies have found consistently that children's expectations for success at academic performance remain high, often unrealistically high, until about the second grade, and continue to decrease, on the average, throughout the elementary grades (Stipek, 1984). There is evidence that by second grade, children begin to integrate past performance information for future performance (Stipek & Hoffman, 1980) and for making judgments of ability.

In a nonexperimental, longitudinal study Entwisle and Hayduk (1978) asked children entering first and second grade to predict the grades they would receive in math and reading. Nearly all first-grade children maintained high, unrealistic expectations despite teachers' and parents' low expectations for some children and despite grades indicating, on the average, lower performance than the children had predicted. Not until the end of the second grade did children's expected grades correlate fairly well with their actual performance. Stipek and Hoffman's (1980) findings further suggested that by the end of first grade, poor performance in school had begun to affect achievement-related expectancies in boys. They also found that high-achieving boys in the first and third grades had higher expectations for success on a novel, academic-like task than low-achieving boys. Nicholls (1979) has shown that between first and sixth grade, children's perceived academic attainment increasingly reflected their actual relative performance in school.

Evidence that young children before age 7 expect success and maintain high perceptions of ability even after a series of objective failure experiences suggests that they are unable to process and integrate a sequence of past failures (Stipek, 1984). This interpretation is consistent with Inhelder and Piaget's (1964) observations that preoperational children have difficulty integrating temporally separate events.

Regarding adolescence, Dweck and Elliot (1983) asserted that individuals formed more coherent pictures of themselves and characterized themselves in terms of even more generalized and stable characteristics, and that the malleable achievement tendencies that characterize younger children may become more resistant to change. Further evidence has suggested a relatively steep decline in self-perceptions of confidence soon after children enter junior high school (Harari & Covington, 1981).

Few researchers have compared children of different grades and ages with respect to causal attributions. In one study Kessel (1979) examined gender differences in causal attributions for math and English courses of 362 sixth and tenth grade students. He found no significant gender differences for sixth grade students. Among tenth grade students, boys attributed their math success significantly more to ability than did girls. Girls attributed their math success more to effort than did boys. In addition, Kessel's tenth grade students perceived math as more sex appropriate for boys than for girls, and boys had higher expectations for success in math than girls.

Gender Issues in Causal Attributions

Numerous researchers have examined sex differences in causal attributions for the general population (Eccles, 1985). Several researchers have suggested that females compared to males are more likely to make causal attributions which could inhibit learning (Deaux, 1976; Nicholls, 1980). While females' self-

defeating causal attributions have been documented in some studies there is much controversy and inconsistency in the evidence (Stipek, 1984). For example, Dweck and Reppucci (1973) and Sweeney, Moreland, and Gruber (1982) failed to find sex differences in ability attributions for failure. Parsons, Meece, Adler, and Kaczala (1982) did not find sex differences in ability causal attributions when an open-ended measure of causal attributions was used.

Sohn (1982) reported in a meta-analysis of attribution studies that the only consistent and "consequential" (i.e., in terms of effect size) finding related to sex differences is the greater use of luck by females to explain successful outcomes. The findings of both children and adults with regards to sex differences in causal attributions are otherwise inconsistent.

Recent research appears to be focused on certain conditions under which gender issues are salient in causal attributions for the general population, as opposed to the question of whether differences exist in general (Stipek, 1984). Deaux's (1976) review of research suggested that sex differences in causal attributions are more pronounced on tasks in which males are believed to be more competent than females. Consistent with this hypothesis, Gitelson, Petersen, and Tobin-Richards (1982) found that high-school aged boys attributed greater ability to themselves for successful outcomes than girls on two spatial tasks (at which males are generally assumed to be more competent), but no sex differences in causal attributions were found for a verbal task (at which females are generally assumed to be more competent). Several researchers (e.g., Ryckman & Peckham, 1987) have found similar results, i.e., females exhibited debilitating causal attributions to a greater degree than males on math tasks. Stipek (1984), for example, tested sex differences in children's causal attributions for success and failure and performance expectations for future tests on a group of 165 fifth and sixth graders taking a regularly scheduled math and

spelling test in their classroom. Sex differences in causal attributions were found for math performance but not in spelling: compared to girls, boys were less likely to attribute failure on the math test to lack of ability and more likely to attribute success to ability than were girls. In addition, girls had lower expectations than boys for their performance on the next math test.

Ryckman and Peckham (1987) examined gender differences in causal attributions for the content areas of mathematics and language arts. They administered a causal attribution questionnaire to children in grades 4 through 11. They found that, generally, girls exhibited debilitating causal attributions (e.g., attributing failure to lack of ability) for math performance when compared to the boys.

Dweck (1986) hypothesized that self-defeating causal attributions for girls may be most prominent for math performance. She suggested a need for further investigation of girls' causal attributions for math performance. Accordingly, Eccles (1985) noted that in attribution studies focusing on mathematics, boys consistently rate ability as a more important cause of their success and effort as a less important cause than girls.

Studies investigating gender differences in causal attributions with regard to sample characteristics have also been documented in the literature, with particular concern given to high-achieving females (Dweck, 1986). These studies have focused on performance in novel task situations and not mathematics. A tendency toward unduly low expectancies (Crandall, 1969); Stipek & Hoffman, 1980), challenge avoidance (Licht, Linden, Brown, & Sexton, 1984), ability attributions for failure (Licht & Shapiro, 1982; Nicholls, 1979), and debilitation under failure has been noted particularly in bright females when compared to bright males (Dweck, 1986). Several researchers have found a negative correlation between their actual ability and these debilitating patterns

(Crandall, 1969; Licht et al., 1984; Licht & Dweck, 1984; Licht & Shapiro, 1982; Stipek & Hoffman, 1980).

A study of sex differences in achievement cognitions and responses to failure with a sample of different achievement levels was conducted by Licht et al. (1984). On the basis of their grades, Licht divided her subjects into A,B,C, and D students and administered a novel task and an attributional measure. A significant sex difference was found among the A students (and only among the A students) in response to failure, with the A girls showing the greatest debilitation of the eight groups and A boys being the only group to show any facilitation. Licht et al. also found a strong sex difference in task preference between A girls and A boys: The A girls much preferred tasks they knew they were good at, whereas A boys preferred ones they knew they would have to work harder to master. In addition, the A girls attributed failure to stable factors (lack of ability) more than the A boys.

Licht and Shapiro (1982) assessed sex differences in causal attributions within achievement levels. Children in the fifth and sixth grades were divided into four achievement levels according to their report cards in mathematics and administered causal attribution questionnaires. Significant sex differences in causal attributions were found, but only among the A students. The high achieving girls were more likely than the high achieving boys to attribute their failure to insufficient ability; they were also less likely to attribute their success to high ability.

In a study related to causal attributions, Licht and Dweck (1984) examined sex differences in response to failure as a function of achievement levels. In their experiment they examined the impact of an initial "confusion" task (vs. "no confusion" task) on subsequent learning and found that high achieving girls who rated themselves as being bright still showed greater debilitation than low-

achieving girls on the confusion task. In the no-confusion condition, the brighter the girls (by her own self-rating and by IQ score), the more likely she was to master the new material ($r=.47$). In the confusion condition, the brighter the girls, the less likely she was to reach the master criterion ($r=-.38$, p diff$<.02$). (For boys in this study the correlation between self-rated ability and task performance tended to increase from the no-confusion to the confusion condition: $r=.15$ and $.34$, respectively). Licht and Dweck concluded that among girls, the ones who viewed themselves as bright (and on the basis of the accuracy of their estimates, presumably were bright) seemed most likely to be debilitated by the confusion. Licht and Dweck also concluded that their research, considered together with other research (e.g., Crandall, 1969; Stipek & Hoffman, 1980), was indicative that the achievement perceptions of girls, particularly bright, high-achieving girls, may hinder them in their attempts to deal with challenging areas such as mathematics.

In a study conducted by Stipek and Hoffman (1980), high-, average-, and low achieving boys and girls in the first and third grades were compared on (a) the expectations for success prior to an anagrams task, (b) their subsequent causal attributions of the causes of failure on the task, and (c) their expectations for future success. Stipek and Hoffman found that boys with a history of low academic success in school had lower expectations for success on the task and tended to be more likely to attribute failure to lack of ability than boys with a history of average or high academic success. In contrast, the high-achieving girls had lower expectations for success than the low-and average-achieving girls and were as likely to attribute failure to lack of ability as the low-achieving girls. Furthermore, children who attributed failure to low ability reported relatively low expectations for future success. Stipek and Hoffman also

commented that "it is remarkable that sex differences in achievement-related expectancies emerge as early as first grade" (p. 865).

Summary

The central thesis of Weiner's theory--that a relation exists between children's causal attributions for success or failure and achievement --has generally been supported in the literature. Researchers investigating sex differences in causal attributions for the normal distribution have produced mixed results, however, although several recent investigations have suggested that sex differences in causal attributions may be prevalent for mathematics performance and among high-achieving students.

With the exception of Stipek and Hoffman's (1980) study in which sex differences in causal attributions among achievement levels were examined among three grade levels in early elementary school, research has not been conducted examining the variables of achievement level, gender, and developmental differences. Furthermore, research in this regard has not been conducted with gifted versus nongifted samples that include students in elementary and junior high school grades, and with regards to mathematics. It is toward meeting this need that the following study is proposed.

CHAPTER 3
METHODOLOGY

Overview of the Study

Causal attributions have been shown to be related to a variety of achievement behaviors and affect. These behaviors include persistence at academic tasks, expectations for future success on academic tasks, self-concept, and task selection. Specifically, many researchers have shown that the attribution of one's failure outcomes to lack of ability and one's success outcomes to effort is related to a preference for non-challenging tasks, a diminished tendency to persist in difficult task situations, a lower self-concept, and a lessened expectancy for success on future academic tasks (Licht & Dweck, 1983, 1984; Stipek, 1984; Stipek & Hoffman, 1980). Researchers have demonstrated that causal attributions are independent of ability, i.e., children of equal ability often have different causal attributions that may influence future achievement outcomes (e.g., Dweck, 1986). Research concerning the causal attributions of gifted students is lacking. This research appears warranted, particularly in the area of math, where gifted females have been underrepresented in advanced math courses and in math-related careers.

Given the paucity of research apparent in relating giftedness and causal attributions, the purpose of this study was to compare the causal attributions of gifted females for mathematics performance with gifted males and nongifted males and females. Responses of students in three grade levels were

compared to assess developmental differences in causal attributions for success and failure outcomes in math.

Subjects

This study was conducted in Polk County, Florida public schools. Polk County is located in Central Florida with a population of 20,000 students. Students from 13 elementary (seven third-grade classrooms and six sixth-grade classrooms) and six junior high school classrooms participated in this study. This study focused on gifted and nongifted boys and girls in grades 3, 6, and 9. The subjects of the current study consisted of those students of teachers volunteering to assist in the study. The teachers participating were employed in one of seven randomly selected Polk County Schools containing the grade levels of concern to this study. The sample consisted of 303 gifted and nongifted children in grades 3, 6, and 9 (see page 44 for the sample size in corresponding grades). Parental approval was obtained from the children participating in this study (see Appendix B).

Of the 303 subjects participating in the current study, 153 subjects (76 male students, 77 female students) were formally identified by a county school psychologist as gifted students. For this study all gifted children had previously obtained an IQ score of 130 or above on an individually administered intelligence test. It is recognized that IQ and giftedness are not always synonymous, and that the debate continues in the literature regarding the use of a score two standard deviations above the mean on an individual intelligence test as the major criteria of giftedness. However, to focus on a clearly delineated subgroup, the present study used an IQ score of 130 or above as a principle criterion for the gifted sample selection. This criterion is consistent with the Florida Department of Education (1988) definition. The remaining subjects in this study were identified as nongifted students. Nongifted males

and females were chosen for this study as a comparison group to gifted females and males, as researchers have indicated that causal attributions can be independent of ability and are not always reflective of actual ability (Dweck, 1986). These nongifted students had not been formally identified as qualifying for the gifted program or were not currently in the process of referral for the gifted program. To screen for the potential confounding effect of these nongifted children possibly qualifying for gifted programs (but as yet not nominated), those students identified as nongifted in this study had obtained stanine scores of five and six for math on previously administered group achievement tests. Students identified as gifted had obtained stanine scores of eight or nine for math on previously administered achievement tests.

This investigator explored whether causal attributions differ as a function of grade. The grades selected for this study (third, sixth, and ninth) were based on the developmental theory of Piaget (1930), research conducted regarding developmental patterns in causal attributions (Stipek, 1984), and findings concerning developmental trends in mathematics participation of gifted females in comparison to gifted males (Eccles, 1985). Third graders were selected because it may take at least two years in school before academic performance histories and sex begin to significantly affect performance-related cognitions (e.g., making realistic self-appraisal estimations) (Stipek & Hoffman, 1980). The increasing use of stable causal attributions (e.g., ability) for performance outcomes typically begin to emerge in late elementary school and sex differences in performance on standardized tests of math performance and in math course selection typically emerge the late junior high or high school years (Eccles, 1985). Thus, sixth and ninth graders were chosen for this study to reflect distinctively different developmental phenomena and their relation to causal attributions. It must be noted that in Polk County sixth grade children are

housed in elementary schools, not in middle or junior high schools as in some other districts.

Procedures

In this study teachers and students were selected as described above based on subject availability, teacher cooperation, school principal permission, and parental permission. Children's causal attributions for math were measured by the Survey of Achievement Responsibility Scale (SARS) (Ryckman, 1986). Teachers of students participating in the study were instructed (see Appendix A) to administer the SARS during their normally scheduled math periods and in their classrooms. The teacher introduced the administration of the instrument by announcing the purpose of the experiment (see Appendix A). To insure students' privacy and to assist the experimenter in identifying the differential subjects of interest in this study, the SARS answer sheets were number-coded according to subjects. The experimenter provided teachers with necessary information in advance in order to identify which students were to receive the appropriate number-coded SARS answer sheets. Those students not obtaining parental permission (147 students total) completed another assignment as directed by the classroom teacher. An additional number of students (52) obtained parental consent and completed the SARS, but were not included as subjects in the current investigation due to their failure to meet the criteria as "gifted" or "nongifted" students for this study. Teachers of third grade students were instructed to read each item and the instructions aloud from the SARS to insure comprehension.

Teachers participating in the experiment were personally briefed regarding the experimental procedures by this experimenter and each received written summaries of standardized procedures to be followed as a reference guide (see Appendix A). These standardized procedures for the administration of the

SARS were emphasized to assure the uniformity of procedures and to minimize teacher effect. The data were collected in January and February of the 1988-89 school year. The need to assess causal attributions for math performance in the students' classrooms is in response to many researchers (e.g., Eccles, 1985; Ryckman & Peckham, 1987) who note that few studies have assessed causal attributions related to school subject areas in naturalistic settings.

Instrumentation

The measurement of causal attributions has been a topic of much concern in the attribution literature. Attribution researchers have shown that causal attributions vary greatly as a function of the question format and that individuals' causal attributions depend to a considerable degree on how the attribution question is asked (Stipek & Weisz, 1981). Numerous studies in the attribution literature have used ipsative, forced-choice formats in measuring causal attributions (the subject is typically asked to indicate one of four causal factors--ability, luck, effort, or task difficulty for achievement outcomes). Marsh, Cairns, Relich, Barnes, & Debus (1984) pointed out various weaknesses of such a format. They suggested that the forced-choice format does not allow children to indicate the degree of difference between any pair of options; this produces a strictly ordinal scale that makes the application of inferential statistics questionable.

In the present study a rating scale questionnaire (the SARS) was used. The SARS is a 24-item paper-and-pencil self-report attributional questionnaire designed to measure a students' causal attributions for success and failure in two academic content areas--math and language. For the purposes of this study, data were collected on the math content consisting of 12 items. Two forms for different grade levels were available, one for elementary grades and one form for junior high school grades. For each of the 12 math items a student

was presented with a situation in which success or failure was explicit. The student's task was to rate four causal attributions (ability, task difficulty, effort, and luck) on a 5-point Likert scale (e.g., "strongly agree"= 1 point) indicating the degree of the likely cause of the success or failure. An example of an item on the SARS assessing causal attributions for a failure outcome included: "You get a low grade in your math class. Why?" For this item, the task for the students was to rate among four options: "You probably didn't do your homework," "you've always had problems with math," "the work was too hard for your class," and "you happened to get a poor teacher." An example of an item assessing causal attributions for a success outcome included: "The teacher praised your math assignment. Why?" The respondents rated among four options: "You were lucky to put down the right answers," "you studied a lot," "the work was easy for all students," and "math is very easy for you." The scores for each set of items were summed to provide subscales (e.g., the responses for the math success situation items were summed into scores for each of the options). This process resulted into eight subscales (four causal attribution choices for success, four for failure). As there were six success and six failure situations, the maximum score for each subscale was 30 and the minimum score was six. The higher score for the success or failure situation indicated that the student attributed their success or failures to one of the four causes (ability, effort, task difficulty, or luck). The SARS required approximately 15 minutes for students to complete.

On the rating scale causal attribution items for the SARS children were asked to rate effort, ability, task difficulty, and luck in terms of importance as a causal explanation for their performance. Justification for this procedure is provided by Elig and Frieze (1979), who showed psychometric advantages in using rating scale techniques in measuring causal attributions, and who also demonstrated

that students themselves are better able to represent their responses on a rating scale than an ipsative-type format. Rating scale procedures in measuring causal attributions have also been used by Buckhalt (1985), Parsons et al. (1982), and Stipek (1984).

The SARS was designed to assess causal attributions in response to hypothetical math experiences students are assumed to experience daily. The SARS was administered in a large scale Effective Schools Project in the Seattle Public Schools in May of 1985. Data were obtained on approximately 20,000 students in middle elementary school through senior high school. Reliability estimates range from .60 to .90 for the math content on the scale. The SARS was chosen to measure causal attributions for math performance in the current study for the following reasons: (1) its rating scale format has psychometric advantages that have previously been identified by Elig and Frieze (1979); (2) its emphasis on measuring causal attributions for math performance, as few scales exist in this regard; (3) its adequate reliability estimates; (4) its basis on Weiner's attribution model; and (5) its two forms corresponding to the grades used in this study.

Variables Under Investigation

There were three independent variables under investigation in this study: sex (male/female), grade (third, sixth, ninth), educational classification (gifted/nongifted) in each outcome situation (success and failure). The four dependent variables in each success and failure outcome were causal attribution scores for ability, effort, task difficulty, and luck as measured by the SARS.

Research Hypotheses

The causal attributions of gifted females for math performance were compared to gifted males and nongifted females and males in grades 3, 6, and 9 in this study. The following hypotheses of interest were tested in this study:

Ho1: There is no interaction among sex, grade, and educational classification for effort causal attributions for failure and success outcomes in math.

Ho2: For each educational classification (gifted and nongifted), there is no interaction between sex and grade for effort causal attributions for failure and success outcomes in math.

Ho3: There is no interaction among sex, grade, and educational classification for ability causal attributions for failure and success outcomes in math.

Ho4: For each educational classification (gifted and nongifted), there is no interaction between sex and grade for ability causal attributions for failure and success outcomes in math.

Ho5: There is no interaction among sex, grade, and educational classification for task difficulty causal attributions for failure and success outcomes in math.

Ho6: For each educational classification (gifted and nongifted), there is no interaction between sex and grade for task difficulty causal attributions for failure and success outcomes in math.

Ho7: There is no interaction among sex, grade, and educational classification for luck causal attributions for failure and success outcomes in math.

Ho8: For each educational classification (gifted and nongifted), there is no interaction between sex and grade for luck causal attributions for failure and success outcomes in math.

Design

The design for this study was a 2 X 3 X 2 three-way factorial design involving sex (male/female), grade (3,6,9), and educational classification (nongifted/gifted) in each outcome (success/failure) (see Figure 1).

Data Analysis

The data for this study in each outcome were initially analyzed using a multivariate analysis of variance (MANOVA) to control for the overall error rate. MANOVA is an appropriate procedure when multiple dependent variables are examined in a study. In this study, the multiple dependent variables were attribution scores for effort, ability, task difficulty, and luck. There were three independent variables: sex, grade, and educational classification. Four separate three-way factorial analyses of variance (ANOVA) were then performed when there were significant differences in the MANOVA, one analysis for each dependent variable with three independent variables: sex, grade, and educational classification. Furthermore, when there was a significant three-way interaction, a two-way factorial ANOVA was conducted in each educational classification (gifted and nongifted) with two independent variables: sex and grade . Finally, the Scheffe test was conducted for all possible pairwise comparisons of the 12 means resulting from the 2 x 3 x 2 factorial design on each dependent variable. The results of the Scheffe test were used to examine at which grade there was a significant sex difference when there was a significant two-way interaction of sex by grade in the preceding ANOVA sorted by educational classification.

		Male		Female	
		Success	Failure	Success	Failure
Gifted	3rd grade	20 students		20 students	
	6th grade	26 students		28 students	
	9th grade	30 students		29 students	
Nongifted	3rd grade	21 students		22 students	
	6th grade	27 students		27 students	
	9th grade	27 students		26 students	

Figure 1. Illustration of a three-way factorial design (sex, educational classification, and grades) in each outcome (success and failure) for a total of 303 subjects.

CHAPTER 4
RESULTS

The purpose of this study was to examine whether gifted female students demonstrated debilitating causal attributions for math performance and whether this performance would differentiate gifted female students from gifted male students and from nongifted male and female students. The study also examined developmental differences in causal attributions for math performance; gifted females were compared to gifted males and nongifted children in their causal attributions for math success and failure outcomes in grades 3, 6, and 9. The School Achievement Responsibility Scale (SARS) was administered to 303 children in a Central Florida school district to assess causal attributions for mathematics performance.

This author has organized this chapter into the following sections: First, the descriptive statistics of the sample is described, followed by the results of the multivariate and univariate analysis of variance to test the hypotheses of interest in this study. These results are reported in success and failure outcomes respectively. Finally, a summary of the overall results of this study are described.

Descriptive Statistics of the Sample

Information regarding causal attributions (i.e., effort, ability, task ease or difficulty, and luck) for math performance in hypothetical success and failure outcomes was collected on 303 subjects for grades 3, 6, and 9. The 303 subjects who participated in the study represented those individuals who

completed and returned parental informed consent forms to this experimenter. Parental consent forms were given by classroom teachers to 502 children. Gifted subjects were identified as those students who were being served in gifted programs and who obtained stanine scores of eight or nine on the Iowa Test of Basic Skills for the mathematics section. Nongifted subjects in this sample were those students who were not currently being served in gifted programs in Polk County Schools, and who obtained stanine scores of five or six on the Iowa Test of Basic Skills for the mathematics section. Seven randomly selected Polk County Schools which housed students in the grade levels of concern to this study participated in this investigation. The number of students in corresponding grades participating in the study is identified on page 44.

Tables 2 and 3 show the summary of sample means and standard deviations for gifted and nongifted males and females in grades 3, 6, and 9 for effort, ability, task, and luck causal attributions for math in success and failure outcomes respectively. In addition, the marginal means of two-way interactions and mains effects are shown in Appendix C. The mean scores represent scores out of a possible total score of 30 on the SARS. For example, the mean effort attribution scores in the math success outcome (see Table 2) for gifted males were 12.75 (SD=3.08), 13.69 (SD=5.35), and 15.67 (SD=7.76) respectively for grades 3, 6 and 9. Gifted females obtained mean scores of 13.20 (SD=3.43), 16.00 (SD=6.40), and 25.48 (SD=3.67) respectively for the three grade levels. The mean effort attribution scores in the math failure outcome (see Table 3) for gifted males were 20.90 (SD=6.38), 23.15 (SD=4.79), and 24.67 (SD=4.43) for grades 3, 6, and 9 respectively. Gifted females obtained mean scores of 22.60 (SD=4.52), 21.29 (SD=5.77), and 14.03 (SD=6.49) respectively for the three grade levels.

Table 2

Means and Standard Deviations in SARS for the Success Outcome.

			Sex			
			Male		Female	
Education	Grade	Attribution	M	SD	M	SD
Gifted	3	Effort	12.75	3.08	13.20	3.43
		Ability	25.00	3.87	24.55	3.55
		Task	12.05	3.36	12.45	3.19
		Luck	10.85	2.58	10.90	2.55
	6	Effort	13.69	5.35	16.00	6.40
		Ability	22.19	5.42	22.64	6.15
		Task	12.46	3.44	13.82	4.20
		Luck	12.35	6.62	14.96	6.94
	9	Effort	15.67	7.76	25.48	3.67
		Ability	24.67	4.51	12.79	5.15
		Task	15.07	3.67	22.52	5.69
		Luck	11.23	3.38	18.83	6.85
Nongifted	3	Effort	18.76	5.99	19.27	5.40
		Ability	18.48	6.33	17.36	5.92
		Task	18.86	5.92	16.23	5.58
		Luck	18.00	6.53	19.32	5.57
	6	Effort	22.96	5.17	24.00	3.93
		Ability	12.22	3.08	11.37	2.98
		Task	17.07	2.28	20.93	4.37
		Luck	20.04	4.63	24.44	4.11
	9	Effort	24.81	4.75	27.19	2.26
		Ability	11.18	4.99	9.08	2.06
		Task	18.89	5.01	21.46	5.85
		Luck	22.11	5.51	26.54	2.47

Table 3

Means and Standard Deviations in SARS for the Failure Outcome.

			Sex			
			Male		Female	
Education	Grade	Attribution	M	SD	M	SD
Gifted	3	Effort	20.90	6.38	22.60	4.52
		Ability	15.30	8.07	10.35	3.18
		Task	12.40	2.74	12.80	3.04
		Luck	12.05	2.42	12.40	3.22
	6	Effort	23.15	4.79	21.29	5.77
		Ability	13.08	5.82	15.07	7.32
		Task	13.73	2.91	14.25	3.97
		Luck	12.19	3.53	14.75	4.65
	9	Effort	24.67	4.43	14.03	6.49
		Ability	10.03	4.19	23.62	6.84
		Task	15.50	3.01	22.52	6.16
		Luck	11.00	4.11	16.62	3.05
Nongifted	3	Effort	18.23	6.00	14.32	5.18
		Ability	16.76	6.91	19.14	6.76
		Task	15.57	3.97	12.14	2.85
		Luck	15.14	3.55	10.64	2.77
	6	Effort	13.55	3.42	12.22	4.24
		Ability	22.93	5.00	25.15	4.65
		Task	16.51	1.97	20.56	3.64
		Luck	16.74	2.81	21.59	5.33
	9	Effort	11.22	3.50	8.85	2.13
		Ability	25.37	3.45	27.12	2.14
		Task	17.44	3.73	17.04	2.46
		Luck	17.19	3.50	14.39	3.21

Success Outcome

A multivariate analysis of variance (MANOVA) was conducted to control for the overall error rate and to consider all the dependent variables simultaneously for the success outcome on the SARS. The four dependent variables were the attribution scores for the four constructs of effort, ability, task, and luck. Results of MANOVA indicated a significant interaction between sex, grade, and educational classification. Wilk's Criterion Test indicated the highest order interaction was significant (F=3.64, p< .05). Because of this highest order interaction, each dependent variable was then examined by four separate analysis of variance (ANOVA). The alpha level for each ANOVA was set at .0125 (i.e., .05 divided by the number of comparisons p, where p=4). Furthermore, when there was a significant three-way interaction (sex by grade by educational classification), two separate ANOVAs were conducted sorted by educational classification (i.e., gifted and nongifted samples). The alpha level was at .0125/p, where p=2. These ANOVAs sorted by educational classification were conducted to delineate the sex differences as a function of grade within each educational classification. Finally, when there was a significant two-way interaction (sex by grade) in the ANOVAs sorted by educational classification, the Scheffe test was conducted to examine at what grade the sex difference occurred. For each construct, the alpha level of the Scheffe test was .05.

Effort

Effort as a construct refers to the likelihood of a subject to ascribe effort as a reason (i.e., causal attribution) for a successful math outcome on the SARS. For effort, the results of ANOVA indicated no three-way interaction (sex, grade, educational level) (F= 3.99, p> .0125). The second order interactions were significant only for sex by grade (F=8.68, p< .0125) indicating that for the

combined population of gifted and nongifted students male-female differences depended on grade. This interaction of sex by grade in the success outcome is displayed in Figure 2. Results of the ANOVA tests at each grade showed a significant difference between females and males to occur only in the ninth grade (F=29.97, p=.0125/3). Girls obtained higher scores for this construct than males.

Ability

Ability as a construct refers to the likelihood of a subject to ascribe ability as a reason (i.e., causal attribution) for a successful math outcome on the SARS. For ability causal attributions in the success outcome, there was a significant three-way interaction between sex, grade, and educational classification (F=11.72, p<.0125). Separate analyses were followed for each separate category of gifted and nongifted subjects. For the gifted students, the sex and grade interaction was significant (F=29.56, p<.0125/2)). The interaction of sex by grade for ability and task for gifted and nongifted students in the success outcome is shown in Figure 3. Results of the Scheffe test indicated that the significant difference occurred only in the ninth grade, with gifted males obtaining higher scores than gifted females. For the nongifted subjects, there was no interaction between sex and grade (F=0.26, p>.0125/2). There was no sex difference (F=3.12, p>.0125/2). However, there was a significant grade difference (F=35.46, p<.0125/2).

In addition, when separate analyses for girls and boys were conducted after the three-way interaction, there was a significant two-way interaction (educational classification and grade) only for girls (F=9.32, p<.0125/2), indicating that the difference between gifted girls and nongifted girls depended on grade. The Scheffe test at each grade showed that gifted girls scored significantly higher than nongifted girls only at grades 3 and 6.

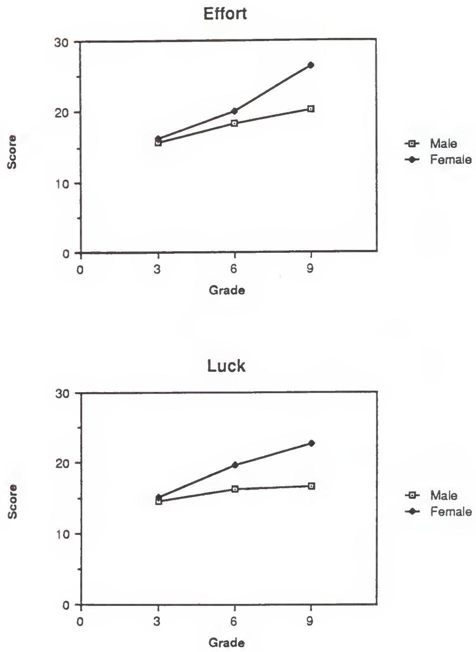
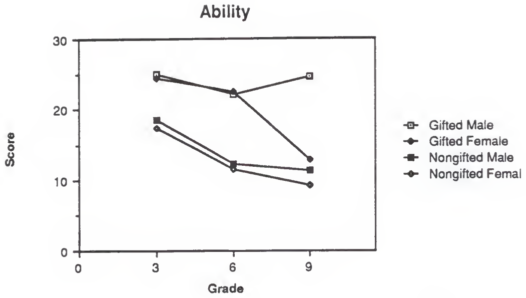


Figure 2. Interactions of sex by grade for effort and luck in the success outcome.



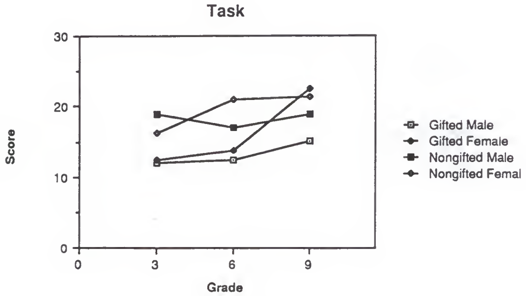


Figure 3. Interactions of sex by grade for ability and task in the success outcome.

Task

Task as a construct indicates the likelihood of a subject to view task ease as a causal attribution for a successful math outcome on the SARS. For task, there was a significant three-way interaction between sex, grade, and education classification (F=4.83, p<.0125). For the gifted subjects, there was a significant interaction between sex and grade (F=9.45, p<.0125/2) (see Figure 3). Results of the Scheffe test indicated that this significant difference to occur in the ninth grade only, with girls obtaining higher scores than boys. For the nongifted subjects, there was a significant interaction between sex and grade (F=6.65, p<.0125/2). However results of the Scheffe test showed no significant difference between nongifted males and nongifted females in any of the three grade levels.

In addition, separate analyses for girls and boys after the three-way interaction revealed that there was a significant two-way interaction (educational classification and grade) only for girls (F=9.40, p<.0125/2), indicating that the difference between gifted girls and nongifted girls depended on grade. The Scheffe test at each grade showed that nongifted girls scored significantly higher than gifted girls only in the sixth grade.

Luck

Luck as a construct refers to the likelihood of a subject to ascribe luck as a causal attribution for a successful math outcome on the SARS. For luck, there was no significant three-way interaction between sex, grade, and education classification (F=1.87, p>.0125). There was a significant (F=6.36, p<.0125) sex by grade interaction, indicating that male/female differences depended on the grade. This interaction of sex by grade in the success outcome is displayed in Figure 2. The ANOVA tests at each grade level showed the male/female

difference to occur in the ninth grade only, with girls obtaining significantly higher scores than boys (F=22.45, p<.0125/3).

Failure Outcome

A multivariate analysis of variance was conducted to control for the overall error rate and to consider all the dependent (i.e., effort, ability, task, and luck) variables simultaneously for the failure outcome. Wilk's criterion test indicated that the highest order interaction of sex by grade by education classification was significant (F=10.48, p<.05). Because this three-way interaction was significant, each dependent variable was then examined by four separate ANOVAs. The level for each ANOVA was set at .0125 (i.e., .05 divided by the number of comparisons p, where p=4). Furthermore, when there was a significant three-way interaction, two separate ANOVAs were conducted sorted by educational classification (i.e., gifted and nongifted samples). The alpha level was at .0125/p, where p=2. These ANOVAs sorted by educational classification were conducted to delineate the sex differences as a function of grade within each educational classification. Finally, when there was a significant two-way interaction (sex by grade) in the ANOVAs sorted by educational classification, the Scheffe test was conducted to examine at what grade the sex difference occurred. For each construct, the alpha level of the Scheffe test was .05.

Effort

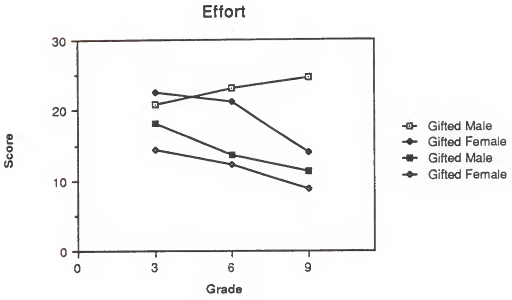
Effort as a construct refers to the likelihood of a subject to ascribe effort as a causal attribution for an unsuccessful (i.e., failure) math outcome on the SARS. A univariate analysis of variance with effort as a dependent variable showed that there was a significant three-way interaction between sex, grade, and educational classification (F=12.42, p<.0125). For the gifted subjects there was a significant sex by grade interaction (F=21.83, p<.0125/2). The interaction of sex by grade for gifted and nongifted subjects in the failure outcome is

displayed in Figure 4. Results of the Scheffe test showed that the significant difference occurred only in the ninth grade, with boys obtaining higher scores than the girls. For the nongifted sample, there was no significant sex by grade interaction ($F=1.70$, $p>.0125/2$). Results indicated a significant sex difference ($F=10.16$, $p<.0125/2$) and a significant grade difference ($F=19.60$, $p<.0125/2$). In addition, separate analyses for girls and boys after the three-way interaction revealed that there was a significant two-way interaction (educational classification and grade) only for boys ($F=15.48$, $p<.0125/2$), indicating the difference between gifted boys and nongifted boys depended on grade. The Scheffe test at each grade showed that gifted boys scored significantly higher than nongifted boys at grades 6 and 9.

Ability

Ability as a construct refers to the likelihood of a subject to ascribe ability as a causal attribution for a failure math outcome on the SARS. Results indicated a significant three-way interaction ($F=18.54$, $p<.0125$) for sex, grade, and educational classification. For the gifted subjects, a significant sex by grade interaction was found ($F=35.12$, $p<.0125/2$) (see Figure 4). Results of the Scheffe test indicated that the significant difference occurred only in the ninth grade, with girls obtaining higher scores than boys. For the nongifted subjects, there was no interaction between sex and grade ($F=0.09$, $p>.0125/2$). There were no sex differences ($F=5.31$, $p>.0125/2$) for the nongifted subjects; however, a significant ($F=27.38$, $p<.0125/2$) grade difference was found.

In addition, separate analyses for girls and boys after the three-way interaction revealed that there was a significant two-way interaction (educational classification and grade) only for boys ($F=18.46$, $p<.0125/2$),



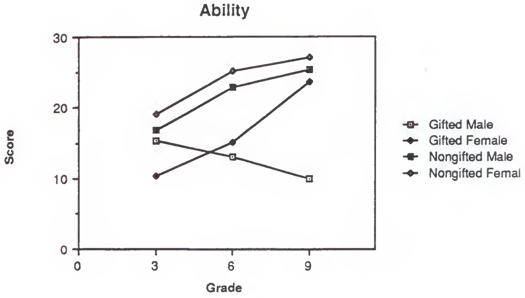
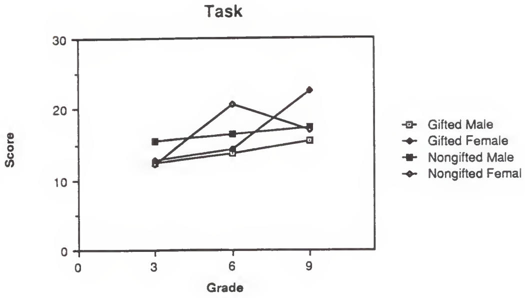


Figure 4. Interactions of sex by grade in the failure outcome.



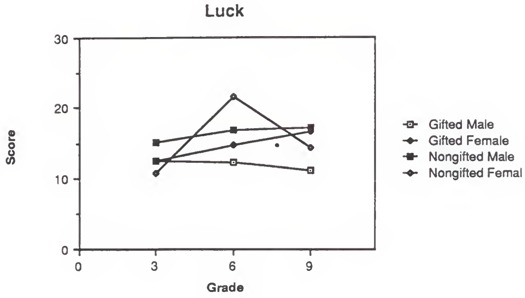


Figure 4 -- continued

indicating the difference between gifted boys and nongifted boys depended on grade. The Scheffe test at each grade showed that nongifted boys scored significantly higher than gifted boys at grades 6 and 9.

Task

Task as a construct refers to the likelihood of a subject viewing task difficulty as a causal attribution for a failure math outcome on the SARS. Results indicated a significant three-way interaction for sex, grade, and educational classification (F=18.54, p<.0125). For the gifted subjects, a significant sex by grade interaction was found (F=15.18, p<.0125/2) (see Figure 4). Results of the Scheffe test indicated that the significant difference occurred only in the ninth grade, with females obtaining higher scores than boys. For the nongifted subjects, a significant sex by grade interaction occurred (F=13.48, p<.0125/2). Results of the Scheffe test, however, indicated no significant difference at any grade level for the nongifted subjects.

In addition, separate analyses for girls and boys after the three-way interaction revealed that there was a significant two-way interaction (educational classification and grade) only for girls (F=30.14, p<.0125/2), indicating that the difference between gifted girls and nongifted girls depended on grade. The Scheffe test at each grade showed that nongifted girls scored significantly higher than gifted girls at grade 6 and that gifted girls scored significantly higher than nongifted girls at grade 9.

Luck

Luck as a construct refers to the likelihood of a subject ascribing luck as a causal attribution for a failure math outcome on the SARS. Results indicated a significant three-way interaction for sex, grade, and educational classification (F=15.15, p< .0125). For the gifted subjects, a significant sex by grade interaction was found (F=6.48, p<.0125/2) (see Figure 4). Results of the Scheffe

test indicated that the significant difference occurred only in the ninth grade, with females obtaining higher scores than males. For the nongifted sample, a significant sex by grade interaction occurred (F=23.55, p<.0125/2). Results of the Scheffe test indicated that there was a significant difference in the sixth grade, with girls scoring higher than boys.

In addition, separate analyses for girls and boys after the three-way interaction revealed that there was a significant two-way interaction (educational classification and grade) only for girls (F=22.96, p<.0125/2), indicating that the difference between gifted girls and nongifted girls depended on grade. The Scheffe test at each grade showed that nongifted girls scored significantly higher than gifted girls only at grade 6.

Overview of Results

Results of MANOVA for the success outcome indicated that there was a significant three-way interaction between sex, grade, and educational classification, indicating the need for separate ANOVAs to be administered. Out of the four separate ANOVAs (i.e., the constructs of effort, ability, task, and luck) a significant three-way interaction was indicated only in ability and task. For effort and luck, on the other hand, there was a significant two-way interaction of sex by grade indicating male/female differences to depend on grade. For both effort and luck, the difference occurred only in the ninth grade with girls scoring higher than boys.

For ability and task in the success outcome, ANOVAs for the gifted sample revealed that there was a significant interaction of sex by grade indicating that differences between gifted males and gifted females depended on grade. Follow-up Scheffe tests revealed this difference occurred only in the ninth grade; gifted boys obtained significantly higher scores than gifted girls for

ability, and gifted girls obtained significantly higher scores than gifted boys for task.

Conversely, for the nongifted sample in the success outcome, there was a significant interaction of sex by grade for task only. This finding indicated that, for task, differences between nongifted boys and nongifted girls depended on grade, although a follow-up Scheffe test did not reveal that there was a significant difference at any of the three grades. For ability (in which there was no significant sex by grade interactions), there was a significant difference in grade, indicating that both nongifted males and females exhibited different causal attribution scores dependent on grade.

In the failure outcome, results of MANOVA indicated that there was a significant three-way interaction among sex, grade, and educational classification. For all four separate ANOVAs (i.e., effort, ability, task, and luck), there was a three-way interaction of sex, grade, and educational classification. ANOVAs for the gifted sample showed a significant interaction of sex by grade on all four constructs, indicating that differences between gifted males and gifted females depended on grade. Follow-up Scheffe tests revealed that this difference occurred only in the ninth grade for all four constructs. Gifted girls obtained higher scores for ability, task, and luck.

For the nongifted sample, there was a significant sex by grade interaction occurring for task and luck. Results of the Scheffe test indicated a significant difference for luck attributions to occur in the sixth grade. Significant sex differences were not revealed for task causal attributions at any of the three grade levels. Both for effort and ability, there was a significant grade difference for the nongifted students. There was a significant sex difference for effort for all three grade levels, indicating that boys obtained higher scores.

Separate analyses sorted by sex was carried out in addition to those sorted by educational classification when there was a three-way interaction of sex, grade, and educational classification for each of the four separate ANOVAs. In these separate analyses gifted boys were compared with nongifted boys, and gifted girls were compared with nongifted girls. On the four success variables, there was a significant difference in the third and sixth grades (ability), and in the sixth grade (task) for girls. In the failure outcome, significant differences were found, for girls, in the sixth and ninth grades (task), and the sixth grade (luck); for boys, significant differences were found in the sixth and ninth grades for both effort and ability.

CHAPTER 5
CONCLUSIONS

Summary

The primary research interests addressed in this study were to investigate the causal attributions of gifted females for math performance relative to gifted males, and to compare these causal attributions with nongifted males and females. In addition, developmental differences in causal attributions for math performance were investigated for all the subjects. A total of 303 subjects in grades 3, 6, and 9, representing 60% of the total number of children invited to participate, were included in this study.

Gifted and nongifted females evidenced self-defeating causal attributions for math performance relative to gifted and nongifted males only in the ninth grade for effort and luck in the success outcome. For four of the remaining six dependent variables, gifted females evidenced self-defeating causal attributions for math performance relative to gifted males only in the ninth grade.

Discussion

Earlier researchers have emphasized the impact of specific causal attributions in success and failure outcomes (Dweck, 1975; Stipek & Weisz, 1981; Weiner, 1972). Weiner (1979), for example, specified in his attributional analysis of achievement motivation that causal attributions of failure to lack of ability and task difficulty decrease subsequent expectations of success on achievement tasks, whereas causal attributions of luck and effort for failure outcomes increase expectations of success. In contrast, success attributed to

ability and task increase subsequent expectations for future success; causal attributions of effort and luck have the effect of decreasing expectations for future success. Numerous investigators have provided support for Weiner's theory regarding the relation of causal attributions and subsequent achievement expectations (e.g., Andrews & Debus, 1978; Fowler & Peterson, 1981; Fyans & Maehr, 1979; Stipek, 1984).

With regard to researchers relating causal attributions to subsequent achievement behaviors, gifted females evidenced self-defeating causal attributions for mathematics performance relative to gifted males on six of the eight dependent variables in this study. Moreover, these significant differences were found only in the ninth grade. At this grade level, gifted females obtained significantly higher scores than gifted males for luck and effort and a lowered score for ability in the success outcome, while in the failure outcome, gifted females scored significantly higher on ability and task and significantly lower on effort. Conversely, and seemingly contradictory, this pattern was reversed on the two dependent variables of task in the success outcome and luck in the failure outcome: gifted females obtained significantly higher scores for both constructs, indicating self-enhancing causal attributions for math performance relative to gifted males on these two constructs.

The finding that gifted females evidenced self-defeating causal attributions for math performance for six of the eight dependent variables in this study was consistent with findings of other researchers who have compared the causal attributions of males and females for math performance for the general population and who have also found that females evidenced self-defeating causal attributions relative to males (Kessel, 1979; Parsons et al. 1982; Ryckman & Peckham, 1987; Stipek, 1984; Wolleat, Pedro, Becker, & Fennema, 1980). Moreover, in comparing the results of the causal attributions for math

performance for the gifted and nongifted subjects in the current study, significant differences between gifted females and gifted males were more numerous than significant differences between nongifted females and nongifted males. These data were consistent with other research in which the characteristic pattern of sex differences in children's causal attributions and expectations for success on novel tasks was more pronounced among high-achieving students; that is, researchers have presented data which suggest that sex-differences in achievement-related cognitions may be strongest among the most academically competent children. (Licht & Shapiro, 1982; Licht et al., 1984; Stipek & Hoffman, 1980; see also Licht & Dweck, 1983; Dweck, 1986).

The results of this study were consonant with other findings that sex differences in mathematical achievement appear to be greatest among high ability students and that sex differences in math achievement become evident and more pronounced during early adolescence (Benbow & Stanley, 1980). For example, investigations of mathematically gifted children have reported male/female discrepancies of a much greater magnitude for this select group than those typically reported for the whole distribution (Benbow & Stanley, 1982; see Eccles, 1985). Furthermore, researchers have shown that, although in the grade school years girls equal boys in mathematical achievement, during the junior high and high school years, boys pull ahead and remain ahead in mathematical achievement (Fennema & Sherman, 1977; Maccoby & Jacklin, 1974; Ruble, 1988). In the present study, significant differences in causal attributions for math performance between gifted females and gifted males were more numerous than differences between nongifted females and nongifted males. In addition, the sex differences in causal attributions for math performance for the gifted subjects became evident in the ninth grade,

indicating that causal attributions for math performance for gifted females became, in general, self-defeating sometime between the sixth and ninth grade.

The findings of the current study are similar to developmental trends found by other researchers examining sex differences in causal attributions for math performance as a function of grade for the general population. Ryckman and Peckham (1987), for example, found that females began evidencing self-defeating causal attributions for math performance when compared to boys in the eighth grade. Kessel (1979) also found sex differences in causal attributions for math performance, with girls showing debilitating causal attributions in the tenth grade relative to boys. These sex differences were not seen in the sixth grade. Several researchers (e.g., Heller & Parsons, 1981; Dweck, 1986), have suggested that stable sex differences in achievement cognitions (i.e., causal attributions) may not occur until late junior high school. The results of the present study were not consistent, however, with Stipek's (1984) finding that sex differences in causal attributions for math performance emerged in the fifth and sixth grade (with girls evidencing self-defeating causal attributions).

The finding in this study that gifted females obtained relatively higher scores than gifted males in task (for the success outcome) and luck (for the failure outcome) in the ninth grade, demonstrating self-enhancing causal attributions for math performance, is inconsistent with the other results of this study and difficult to interpret. It is possible that, although Weiner (1972) theorizes that causal attributions to stable factors (i.e., task) for success outcomes and causal attributions of unstable factors (i.e., luck) for failure outcomes lead to increased expectations for success on subsequent tasks, this aspect of his theory has not been thoroughly researched. The majority of researchers in the attribution literature have focused their attention to the causal attributions of ability and

effort with regard to achievement implications (see Stipek & Weisz, 1981). Perhaps the constructs of task and luck need be reexamined and further researched to draw firmer conclusions about the implications of these causal attributions for achievement strivings.

Particularly intriguing in the current study was the comparison of gifted females and nongifted females. Although gifted females evidenced self-enhancing causal attributions for math performance relative to nongifted females in the third and sixth grade for ability in the success outcome, by the ninth grade no significant differences were found between the two groups. This finding reinforced the idea that causal attributions for math performance can be independent of actual ability and were similar to findings from other studies in which it was shown that causal attributions of high achieving girls were unrelated to their competence (e.g., Licht et al., 1984). Conversely, gifted males evidenced self-enhancing causal attributions for math performance when compared to nongifted males in the sixth and ninth grades on the construct of ability causal attributions in the failure outcome. Based on this finding, gifted males appear to be realistically processing their past successful performance in mathematics and relating their past performance to future expectancies of success in mathematics.

Implications

Reis and Callahan (1989) have emphasized the mandate for educators to assist gifted females in realizing their potential and at the same time to challenge dilemmas that block gifted females' success. Gifted females in ninth grade in this study, in general, demonstrated self-defeating causal attributions for math performance relative to gifted males. In the same vein, the fact that gifted females and gifted males have had similar levels of academic attainment, but dissimilar levels of perceived ability, was evidenced in the current study.

The causal attributions for math performance exhibited by the gifted females could inhibit their educational performance and limit their choices regarding advanced math courses. In addition, it is suggested in view of the results of this study, that the self-defeating causal attributions for math performance evidenced by gifted females relative to gifted males could be contributing to the tendency of gifted female achievement to fall behind gifted male achievement in math during and after the high school years.

Gifted females' self-defeating causal attributions for math performance relative to gifted males on six of the eight dependent variables became evident in this study during the junior high school years, and were not present in earlier grades. Perhaps it is the case, as Dweck (1986) has pointed out, that for gifted students, grade school may not substantially provide tasks that require the acquisition of complex, novel, and difficult concepts required to create failure nor the choice of not pursuing a given subject area. For these reasons, self-defeating causal attributions for math performance may not typically come into play during these grade levels. However, as Dweck (1986) has further posited, it may be that only in subsequent years, i.e., late junior high and high school, that self-defeating causal attributions will have an impact on achievement. During these years, children who evidence self-defeating causal attributions for math performance may elect to avoid challenging courses of study or drop out of courses that pose a threat of failure. In addition, math drop-out behavior may subsequently narrow career choices since the potential to take advanced math courses could be hindered by self-defeating causal attributions.

In a related study, Dweck and Licht (1980) have also found that the nature of the acquisition process in mathematics provides repeated opportunities for initial failure and for children who evidence self-defeating causal attributions to conclude that they lack ability. Dweck (1986) has suggested that the

acquisition demands of mathematics become increasingly novel and difficult in the junior and senior high school years, thus math may appear to adolescents to require more ability than other subjects. One could expect, then, based on the results of the current study, a sharper decline in math than in other subjects. Success in mathematics could be perceived by gifted females as more dependent on ability than success in other subjects. If so, the presence of self-defeating causal attributions for math performance could be a part of or a major contributor to the discrepancy between gifted female and male achievement after the junior high school years. There is some evidence that students in general think that they are less likely to succeed in mathematics than in language arts (Eccles et al., 1984).

The possibility exists in explaining the implications for the sex differences found in the ninth grade in the present study that sex-role stereotyping exerts an influence on causal attributions for math performance. Several authors (e.g., Dweck, 1986; Licht & Dweck, 1983) have suggested that during adolescence standards for achievement become more sex-stereotyped. It is a possibility that gifted females may become more concerned with other areas of competence than boys; in addition they may perceive success in math as contrary to sex-role expectations.

From the findings of this study it appears that there is a need for motivational interventions to assist gifted females in realistically processing their abilities for mathematics. It has been demonstrated that individuals' causal attributions for success and failure outcomes on a variety of tasks can be trained with the effect of enhanced achievement strivings (e.g., Andrews & Debus, 1978; Craske, 1985). To date, however, attribution training programs have not been systematically developed for mathematics. Based on the results of the current

study there appears to be a need to create and implement attribution training programs in math.

Motivational interventions have been conducted with less able students, such as those served in learning disabled and mentally retarded special programs. The implication from the results of this study are that gifted females, who in the elementary school years show no impairment in their math performance, may be prime candidates for attribution training in order for them to succeed in secondary math programs. Furthermore, it is suggested from the results of this study that the need for attribution training is of greatest importance in the junior high school years, when gifted females are beginning to evidence debilitating causal attributions for mathematics performance.

Limitations

There were several limitations of this study. The sample in this study was limited to students in one school district. Thoughtful attention must be paid to the external validity of this experiment, to avoid the tendency to overgeneralize these experimental findings to all children based on the data from this study.

Secondly, the subjects used in the sample were voluntary. School principals and classroom teachers also were voluntary participants in this study. All students had to obtain permission by parents in order to participate. Volunteers, by virtue of their willingness to participate, bias the sample while those unwilling to participate perhaps exclude divergent views which would significantly affect the results.

The Survey of Achievement Responsibility Scale is a self-report measure. Self-report inventories are often biased by the subjectivity and social desirably of the subjects' responses. In addition, the SARS is a relatively new instrument and thus few studies have been conducted in which it was evaluated. The

SARS, however, is one of the few instruments in the area of causal attributions for mathematics performance.

Finally, the current study was descriptive and therefore did not use an experimental design. This study was based on self- perceptions of the subjects and therefore the results are subjective in nature.

Recommendations for Future Research

In the current study, groups of children of different ages were observed at the same time via a cross-sectional design. Perhaps future researchers could incorporate longitudinal research to monitor the developmental trends in causal attributions for gifted females for mathematics performance. Additionally, many researchers who use age as one variable have begun to use a combination of cross-sectional and short-term longitudinal designs (Baltes, Cornelius, & Nesselroade, 1979; Schaie, 1973). This combination would reduce the problem of using either longitudinal approaches alone (e.g., minimizing practice effects) and cross-sectional approaches alone (e.g., minimizing the cohort effect). The combination of cross-sectional and longitudinal research could be useful in assessing, more precisely, the developmental course of gifted females' causal attributions for math performance.

It is recommended that follow-up studies be conducted to identify what happens to gifted females who evidence self-defeating causal attributions for math performance in the ninth grade. Do these females choose not to enroll in advanced math courses? Do these females choose not to pursue math-related careers?

The assessment of causal attributions for gifted females in different subject areas is suggested, based on the results of this study. Differences in perceptions of success and failure in mathematics between gifted ninth grade males and females were noted in the current study. Are there other related

subject areas (e.g., science) that can be studied to assess gifted females' causal attributions for success and failure.outcomes?

Measurement issues are relevant in assessing causal attributions. Studies of reliability and validity issues in relation to causal attributions need to be developed. Attribution scales can be refined to not only measure causal attributions for mathematics, but for other subject areas as well. Given the limitations of self-report measures (i.e., subjectivity and social desirability), perhaps alternative measurement systems need to be developed to directly assess causal attributions in the classroom. Similar measures for parents and teachers to report their observations could be developed and considered along with the students' self-report. Perhaps behavioral observation methodology could be developed and incorporated into the measurement of causal attributions.

Investigations of appropriate intervention strategies to remediate self-defeating causal attributions for math performance that gifted females evidenced in this study need to be validated. Interventions that help gifted females develop a realistic, self-enhancing belief system about performance and ability in mathematics need to be developed. Systematic approaches to train or retrain gifted females' causal attributions for math need to be developed and validated in the classroom. These efforts need to become a part of the training and priorities of school counselors, school psychologists, and math educators.

APPENDIX A
TEACHER REFERENCE--PROCEDURES

1. Before handing out the SARS, the teacher will announce: "As part of an experiment conducted at the University of Florida, I have a questionnaire I want you to fill out that talks about situations in school. They're interested in knowing the reasons young people give for their performance on math tests. Read the instructions carefully and fill it out. I will collect them in 15 minutes. You are not being graded on this questionnaire so there are no right or wrong answers. Think carefully on each question, take your time, and answer the items the best way you can." Teachers of third grade students will read the instructions and items of the SARS aloud. Teachers will also remind the students that, despite parental consent, participation is still voluntary on their part and that they can withdraw at any time without prejudice.

2. The teacher will then distribute the SARS as follows according to a number code on the bottom right side of the instrument : #1 copies will be administered to gifted females, #2 copies to nongifted females, #3 copies to gifted males and #4 copies to nongifted males. The actual SARS with no number inscribed will be administered to those students not falling in one of the four categories. The experimenter will provide information as to which child receives the appropriate copy. Those children not obtaining parental permission will be instructed by the teacher to engage in another activity for approximately 15 minutes. Teachers should refrain from answering questions as to why children receive certain numbers if asked (it is not expected to be asked). The teacher should answer such questions with "It's so the researchers can be better organized." Teachers should be walking around the classroom to insure student comprehension on the questionnaire.

3. After approximately 15 minutes, collect the questionnaires. Collect them all at once. If a student finishes early, have him/her sit quietly until the allotted time is expired (or all the students are finished).

APPENDIX B
PARENTAL INFORMED CONSENT

Participant's Name:

Project Title: Causal Attributions for Math Performance.

Principal Investigator: John D. (Jack) Cramer, Ph.D. Candidate, University of Fla., Gainesville. Phone: (904)-375-1951. Address: 2306 SW 13th St. #903, Gainesville, Fla.

I agree to allow my child to participate in this study as explained below:

The aim of this study is to assess the reasons (causal attributions) children give for their performances in math. The information collected will be used to better understand why some children have difficulty in mathematics. The names of those who participate will not be included in any report. To participate in the study your child will be asked to complete a questionnaire which assesses the explanations children give for their performance in math. Participation or non-participation will not affect your child's grade. The questionnaire requires approximately 15 minutes to complete and will be administered in your child's classroom by his/her classroom teacher. No discomfort is anticipated in completing the questionnaire. Monetary compensation will not be provided. Although no imminent benefits to your child are expected by participating in this study, your child's participation will aid in the increased understanding of children's achievement motivation in mathematics. Please feel free to ask any further questions you may have concerning the nature and outcome of this study. Please keep this portion (above the line) for your records.

The above stated nature and purpose of this study have been explained to me. I also understand that I may withdraw my consent at any time. This information will remain confidential.

I have read and I understand the procedure described above. I agree to allow my child ____________________ to participate in the math attribution questionnaire and I have received a copy of this description. If agreed, please have your child take this portion back to his/her teacher.

Signed (Parent): ______________________ Date:

2nd Parent (optional): ___________________ Date:

APPENDIX C
MEANS OF TWO-WAY INTERACTIONS AND MAIN EFFECTS IN SARS

Grade x Sex

		Success		Failure	
		Sex		Sex	
Grade	Attribution	Male	Female	Male	Female
3	Effort	15.76	16.24	19.57	18.46
	Ability	21.74	20.96	16.03	14.75
	Task	15.46	14.34	13.99	12.47
	Luck	14.43	15.11	13.60	11.52
6	Effort	18.33	20.00	18.35	16.76
	Ability	17.21	17.00	18.00	20.11
	Task	14.77	17.38	15.12	17.41
	Luck	16.20	19.70	14.47	18.17
9	Effort	20.24	26.34	17.95	11.44
	Ability	17.93	10.94	17.70	25.37
	Task	16.98	22.00	16.47	19.78
	Luck	16.67	22.69	14.10	15.51

Grade x Educational Classification

		Educational Classification		Educational Classification	
Grade	Attribution	Gifted	Nongifted	Gifted	Nongifted
3	Effort	12.98	19.02	21.75	16.28
	Ability	24.78	17.92	12.83	17.95
	Task	12.25	17.55	12.60	13.86
	Luck	10.88	18.66	12.23	12.89
6	Effort	14.85	23.48	22.22	12.89
	Ability	22.42	11.80	14.08	24.04
	Task	13.14	19.00	13.99	18.54
	Luck	13.66	22.24	13.47	19.17

APPENDIX C -- continued

		Success		Failure	
Grade x Educational Classification -- continued					
		Educational Classification		Educational Classification	
Grade	Attribution	Gifted	Nongifted	Gifted	Nongifted
9	Effort	20.58	26.00	19.35	10.04
	Ability	18.73	10.13	16.83	26.25
	Task	11.26	20.18	19.01	17.24
	Luck	15.03	24.33	13.81	15.79
Sex x Educational Classification					
		Educational Classification		Educational Classification	
Sex	Attribution	Gifted	Nongifted	Gifted	Nongifted
Male	Effort	14.04	22.18	22.91	14.33
	Ability	23.95	13.96	12.80	21.69
	Task	13.19	18.27	13.88	16.51
	Luck	11.48	20.05	11.71	16.36
Female	Effort	18.23	23.72	19.31	11.80
	Ability	19.99	12.60	16.35	23.80
	Task	16.26	19.54	16.52	16.58
	Luck	14.90	23.43	14.59	15.54
Main Effects	Attribution				
Sex					
Male	Effort	18.11		18.62	
	Ability	18.96		17.25	
	Task	16.07		15.19	
	Luck	15.76		14.05	
Female	Effort	20.86		15.55	
	Ability	16.30		20.08	
	Task	17.90		16.55	
	Luck	19.17		15.07	

Main Effects	Attribution	Success	Failure
Educational Classification			
Gifted	Effort	13.80	21.10
	Ability	21.97	14.58
	Task	14.73	15.20
	Luck	13.19	13.17
Nongifted	Effort	22.83	13.07
	Ability	13.28	22.75
	Task	18.91	16.54
	Luck	21.74	15.95
Grade			
3	Effort	16.00	19.01
	Ability	21.35	15.39
	Task	14.90	13.23
	Luck	14.77	12.56
6	Effort	19.16	17.55
	Ability	17.11	19.06
	Task	16.07	16.26
	Luck	17.95	16.32
9	Effort	23.29	14.69
	Ability	14.43	21.54
	Task	19.49	18.13
	Luck	19.68	14.80

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BIOGRAPHICAL SKETCH

John Davies Cramer was born in Dayton, Ohio, on January 8, 1954. He attended Southeastern College in Lakeland, Florida, where he received his B.A. degree in 1977. He received his M.A. in guidance and counseling from Rollins College, Winter Park, Florida, in 1979, and his Ed.S. from the Department of Counselor Education, Community Agency Track, at the University of Florida in 1981.

Following his completion of the Ed.S degree, Mr. Cramer became employed at the Mental Health Services of Orange County (MHSOC), Orlando, Florida. At MHSOC, Mr. Cramer provided individual, group, and family therapy for a wide range of adults and children with mild to severe emotional problems.

Mr. Cramer began his doctoral studies in counselor education, school psychology track, August, 1986, at the University of Florida. During his doctoral studies, he became employed at the Alachua County Work Release Center, Gainesville, as a therapist providing evaluation, diagnosis, and counseling for adjudicated adults. Mr. Cramer is currently employed as a school psychologist at the A. Quinn Jones Center in Gainesville. He is a nationally and state certified school psychologist, and a member of the American Psychological Association, the National Association of School Psychologists, and the Florida Association of School Psychologists.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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